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Pollutant Reduction Plan for the Arroyo Colorado

Segments 2201 and 2202
Hidalgo, Cameron, and Willacy Counties

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Prepared by the:
Chief Engineer's Office, Water Programs, TMDL Section

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EXECUTIVE SUMMARY

The Arroyo Colorado, a 90-mile long tidal stream located near the mouth of the Rio Grande River in south Texas, has been included on Texas' list of impaired water bodies (Clean Water Act Section 303(d) List)[1] since 1978 due to the occurrence of low dissolved oxygen (DO) in the tidally-influenced portion of the stream. In 2002, the State of Texas completed the first phase of a total maximum daily load (TMDL) study which showed that extensive physical modifications and excessive loading of nutrients cause oxygen depletion in the boundary between the fresh water and tidally influenced portions of the stream. The 2002 TMDL study did not result in a realistically achievable loading limit of pollutants of concern in the Arroyo Colorado because there was insufficient information to determine how much of the low DO problem was associated with excessive nutrient loading and how much was the result of physical modifications of the stream. However, the TMDL study showed that improvements in water quality, including higher DO levels, can be achieved by reducing nutrient loading into the stream.

The Texas Commission on Environmental Quality (TCEQ) is continuing efforts to determine a TMDL for the Arroyo Colorado. At the same time, the TCEQ is promoting efforts to reduce nutrient loading through the development of a Watershed Protection Plan (WPP) for the Arroyo Colorado. Stakeholders in the watershed will implement the Arroyo Colorado WPP in 2006. The TCEQ expects to complete Phase II of the Arroyo Colorado DO TMDL in 2008.

A major component of the Arroyo Colorado WPP is an effort to reduce pollutants entering the Arroyo Colorado from domestic and municipal wastewater flows. This document describes the regulatory and voluntary measures already taken and planned for the next ten years to reduce the loadings of nutrients, Biochemical Oxygen Demand (BOD), and suspended solids from sanitary wastewater flowing into the Arroyo Colorado. The plan estimates the historical and projected reductions in loadings of pollutants of concern to the Arroyo Colorado from the 18 principal point source contributors of wastewater and from the mitigation of nonpoint sources of wastewater to the Arroyo Colorado in five-year planning intervals beginning in the year 2000 and ending in the year 2015. The measures contained in the plan include institutional controls (i.e., changes in permit limits), wastewater infrastructure improvements designed to mitigate nonpoint sources of pollution and to improve current wastewater treatment levels, and enhanced biological treatment projects such as reuse via irrigation, polishing ponds and constructed wetland cells.

In addition to load reduction estimates, the plan describes additional monitoring requirements and provides estimates of the technical and financial resources needed to achieve

the planned reductions. Also described in the plan is an implementation schedule with the interim milestones and measures of success expected throughout the implementation of the plan.

INTRODUCTION

Section 303(d) of the Clean Water Act (CWA) requires all states to identify waters that do not meet, or are not expected to meet, applicable water quality standards. For each listed water body that does not meet a standard, states must develop a TMDL for each pollutant that has been identified as contributing to the non-attainment of water quality standards in that water body. The TCEQ is the agency of the State of Texas responsible for ensuring that all waters of the state are in compliance with applicable Surface Water Quality Standards[2] and that TMDLs are implemented to address pollutants responsible for non-attainment.

In keeping with the state of Texas' commitment to restore and maintain water quality in water bodies that do not meet established water quality standards, the TCEQ recognizes that, in certain instances, watershed plans must be established for water bodies in which a TMDL has not been developed, but where certain actions and measures can be implemented to improve or restore water quality in a segment listed on the state's 303(d) list.

US Environmental Protection Agency (USEPA) guidance on the development of TMDLs[1] offers flexibility in addressing particular situations and mitigating circumstances, allowing States the discretion to adopt different approaches to address non-attainment of water quality standards where appropriate.

USEPA CWA Section 319 guidance (2003)[4] specifies the information appropriate for a watershed plan designed to meet the goals of the CWA in the absence of a TMDL and the elements of a watershed plan which use CWA section 319 funds for implementation to satisfy CWA requirements commensurate with those of a TMDL. This document is structured to address the nine elements specified in EPA CWA Section 319 guidance.

This plan was developed by the TMDL Section of the Water Programs of the Chief Engineer's Office, of the TCEQ with the participation of the Wastewater Infrastructure Work Group of the Arroyo Colorado Watershed Partnership. Technical assistance was provided by staff from Texas Sea Grant College, Texas Parks and Wildlife Department (TPWD), the Texas Water Development Board (TWDB), and Alan Plummer and Associates, Inc.

Legal Authority

The plan described in this document is composed primarily of voluntary measures undertaken and planned by the principal point source contributors of pollutants of concern to the Arroyo Colorado. However, under Section 309.2(b) of title 30 of the Texas Administrative Code (relating to Rationale for Effluent Sets), the TCEQ has the legal authority to institute modifications to the uniform sets of effluent criteria listed in 30 TAC §309.4, and it may consider limits more stringent than secondary treatment if the commission determines these limits are required in order to maintain desired water quality levels. The

TCEQ may set effluent criteria stringent enough to protect aquatic life in the Arroyo Colorado. The TCEQ will exercise this legal authority judiciously if voluntary measures do not result in the achievement of Water Quality Standards in the Arroyo Colorado.

Background Information

The classified segments that comprise the Arroyo Colorado (2201 and 2202) have consistently failed to meet the water quality standards established by the State of Texas as reported in State of Texas Water Quality Inventory Reports (CWA Section 305(b) reports) and lists of impaired water bodies (CWA Section 303(d) lists).

In the upper 7.1 miles of the tidally influenced segment of the Arroyo Colorado (segment 2201), DO concentrations are sometimes lower than the criteria established to assure optimum conditions for aquatic life. This portion of the Arroyo is known as the zone of impairment. Nutrient enrichment concerns are also noted for this portion of segment 2201 in the draft 2004 Texas Water Quality Inventory (305b) Report, indicating that concentrations of ammonia and nitrate plus nitrite exceed the 85th percentile of all tidal streams assessed in Texas.[1] In the non-tidally influenced segment of the Arroyo Colorado (Segment 2002,) fecal bacteria concentrations currently exceed levels established by the state for safe contact recreation. Also, in the portion of the Lower Laguna Madre located at the confluence with the Arroyo Colorado, DO concentrations are also sometimes lower than the criteria established to assure optimum conditions for aquatic life and preliminary data collected by the USGS shows evidence that the Lower Laguna Madre is beginning to show adverse effects from excessive nutrient loadings which can be linked directly to the Arroyo Colorado. The USGS study cites the possibility that over-stimulation of growth in drift algae induced by excessive nutrient loading may hamper the propagation of sea grasses, thereby reducing important fish habitats.[5,6]

Between 1998 and 2002, the State of Texas conducted a TMDL analysis of the Arroyo Colorado. The TMDL analysis concluded that the altered physical condition of the Arroyo Colorado contributes significantly to the observed DO impairment in the tidal segment of the stream (segment 2201) and that even extreme reductions (up to 90%) in the loading of constituents of concern into the Arroyo Colorado will not achieve the TMDL endpoint target, which is defined as a 90% rate of compliance with the DO criteria currently applied to the tidal segment of the Arroyo Colorado (24-hr average DO of 4.0 mg/l and a 24-hr minimum DO of 3.0 mg/l)[7]. The TCEQ does not regard this TMDL load reduction target (90%) to be realistically achievable.

A second conclusion of the TMDL analysis, based primarily on self-reported data and available monitoring, is that a significant volume of poorly treated and essentially untreated wastewater enters the Arroyo Colorado between the cities of Mission and Rio Hondo along with nutrients, BOD, and sediment from agricultural nonpoint sources.

Given the first conclusion of the TCEQ's TMDL study (90% reduction target), the 2002 TMDL analysis does not support a quantitative, water quality target-based allocation of loadings of pollutants associated with DO dynamics in the tidal segment of the Arroyo Colorado. However, the TMDL analysis shows improvements in water quality and a po-

tential reduction in the environmental stresses to aquatic life through the reduction of nutrients, BOD, and sediment loadings into the Arroyo Colorado. Efforts to improve water quality in the Arroyo Colorado should, therefore, include reductions in the loading of nutrients, BOD, fecal bacteria and suspended solids entering the Arroyo Colorado along with improvements in biological habitat, assimilative capacity and hydraulic circulation.

In 2003, the TCEQ initiated efforts to develop a local plan to address non-attainment of water quality standards in the Arroyo Colorado. The stakeholder group associated with this project, the Arroyo Colorado Watershed Partnership, (in cooperation with the TCEQ) formed several workgroups to address and develop seven major components of the Arroyo WPP. The WPP components are the following:

- Agricultural Issues
- Wastewater Infrastructure
- Habitat Restoration
- Further Study/ Refinement of TMDL Analysis
- Outreach and Education
- Monitoring
- Land Use and Development

The seven workgroups created to address the issues associated with each of the WPP components described above have developed recommendations for improving water quality in the Arroyo Colorado. This document describes the recommendations of the Arroyo Colorado Wastewater Infrastructure Workgroup, led by the TCEQ.

The goals of the Wastewater Infrastructure Workgroup are to:

1) Improve the quality of treated effluent from as many facilities as is practicable
2) Increase wastewater and storm water infrastructure development for rural and unincorporated low income communities in the Arroyo Colorado watershed, collectively known as colonias
3) Implement as many enhanced biological treatment projects as is feasible and practicable
4) Focus Phase II Storm Water Management Programs on the pollutants of concern in the Arroyo Colorado

The pollutant reduction plan described in this document is, in fact, the wastewater infrastructure component of the larger watershed protection plan (WPP) for the Arroyo Colorado. The plan has been designed to achieve reductions in concentrations of total nitrogen, total phosphorus, BOD, and Total Suspended Solids (TSS) in the tidal segment of the Arroyo Colorado. Reductions in the concentration of fecal pathogens (including E-coli) in the above-tidal segment of the Arroyo Colorado are also expected as an ancillary benefit of the plan. Additionally, this watershed plan seeks to augment the improvement of aquatic habitat in both segments of the Arroyo Colorado (segments 2201 and 2202) further helping to satisfy the requirements specified under section 303(d) of the CWA.

SOURCE ANALYSIS

Pollutants of concern enter the Arroyo Colorado from many different sources in the watershed. The focus of this document is on pollutants associated with domestic and municipal wastewater. There are three main sources of wastewater in the Arroyo Colorado watershed: 1) discharges of wastewater from permitted treatment facilities directly to the Arroyo Colorado or into ditches that flow into the Arroyo Colorado and 2) wastewater from on-site treatment systems typically generated by residents living in rural areas and 3) wastewater generated by residents of low-income rural, and non-incorporated suburban, communities known as colonias. The sources described under category one above emanate from well-defined locations and are commonly referred to as point sources of pollution. Perennial flow in the Arroyo Colorado is sustained by municipal wastewater point sources especially during dry periods. The second and third source categories are known collectively as nonpoint sources (NPS) of wastewater. Pollutant loading of the Arroyo Colorado from NPS typically occurs during rainfall runoff events. Each type of wastewater source discussed above is described in more detail in the following sections.

Permitted Wastewater Treatment Facilities

There are currently 38 active wastewater discharge permits associated with the Arroyo Colorado (33 municipal and domestic wastewater facilities and 5 industrial facilities). Together, the facilities have a total permitted flow of approximately 209 million gallons per day (209 MGD). Approximately two thirds of the total permitted wastewater flow in the watershed (150 MGD) is associated with the discharge permits of two aquaculture facilities located along the tidal portion of the Arroyo Colorado 12 miles downstream of the Arroyo's zone of impairment and near the confluence with the Laguna Madre. Thirty-four of the 38 discharge permits are for outfalls that discharge into portions of the watershed that drain into Segment 2202 (Arroyo Colorado above tidal); 4 are for outfalls that discharge directly into Segment 2201 (Arroyo Colorado above tidal) or to portions of the watershed that drain into Segment 2201 (Table 1).

Figure 1 shows the location of wastewater facilities within the Arroyo Colorado watershed. Although classified by the TCEQ as discharging into the Arroyo Colorado, it should be noted that six of the wastewater outfalls listed Table 1 are located outside the Arroyo Colorado watershed and do not contribute directly to the classified segments of the Arroyo Colorado. All of the permitted outfalls located outside of the Arroyo Colorado watershed are small domestic wastewater facilities with non-direct discharges (i.e., subsurface drain fields or subsurface pressure injection). Additionally, of the 38 discharge permits shown in Figure 1, only 23 have outfalls directly into the Arroyo Colorado or to drainage ditches that flow into the Arroyo.

Much of the information known about permitted point source contributions to the Arroyo Colorado was collected by the TCEQ during the TMDL analysis completed in 2002. From monthly effluent data submitted to the TCEQ as part of self-reporting requirements specified in individual Texas Pollution Discharge Elimination System (TPDES) permits, the TCEQ assembled detailed information regarding actual flow and loading of BOD, total suspended solids (i.e., sediment) and, in some cases, ammonia nitrogen produced by

municipal point sources in the watershed. The TCEQ also obtained information regarding municipal point source loadings of constituents such as nitrate plus nitrite, total kjeldahl nitrogen, total phosphorus, and orthophosphate from monitoring of wastewater effluents performed voluntarily by permitted wastewater treatment facilities in the watershed and from special effluent monitoring conducted by the Texas Natural Resource Conservation Commission (now the TCEQ) as part of the TMDL effort in 2000 and 2001. This information was assembled and entered into a Watershed Data Management File (WDM file) in the form of time series for input into a dynamic watershed and water quality model used to simulate water quality in the Arroyo Colorado.

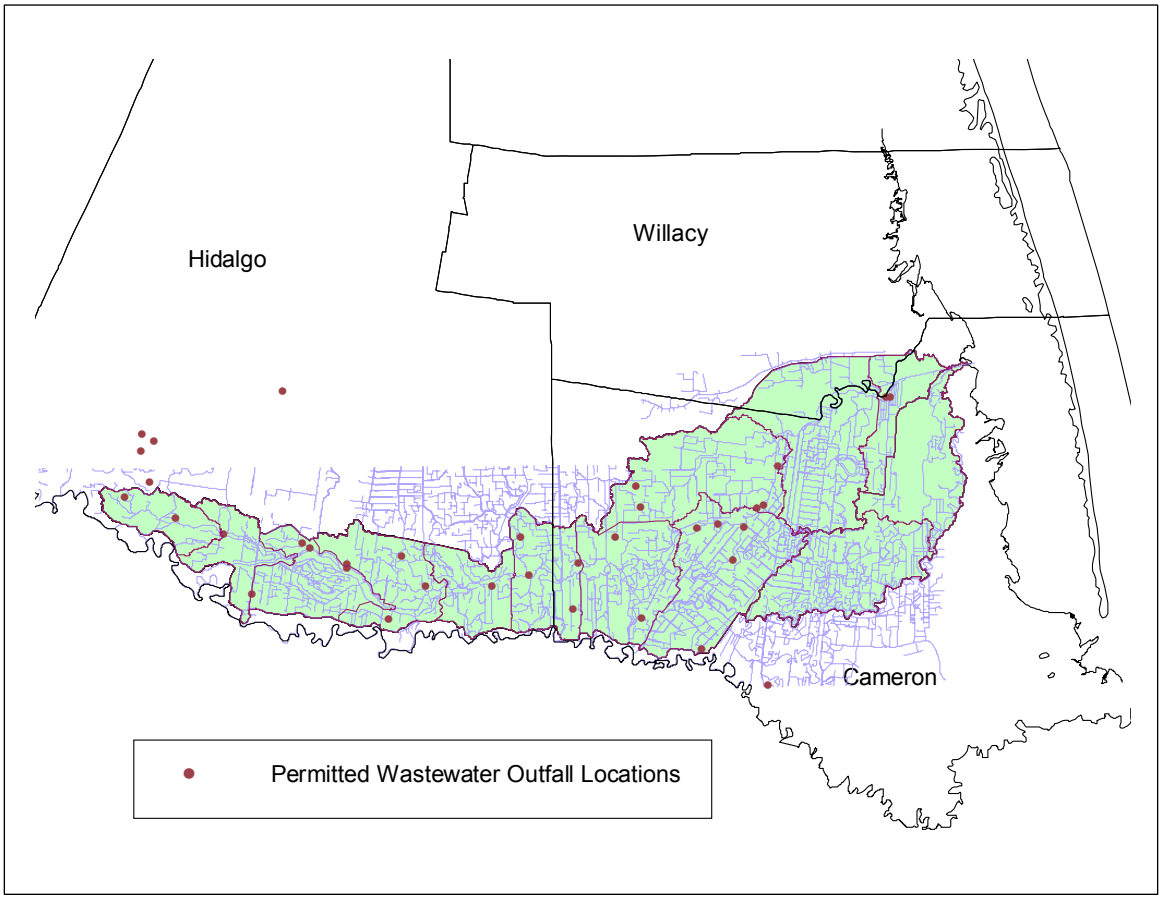

Figure 1. Location of wastewater treatment facilities in the Arroyo Colorado watershed and watershed sub-basins

The TMDL analysis conducted on the Arroyo Colorado in 2002 concluded that municipal wastewater facilities in the Arroyo Colorado watershed accounted for 23% of the BOD, 22% of the ammonia nitrogen, 20% of the nitrate nitrogen, and 40% of orthophosphate entering the Arroyo Colorado between 1989 and 1999 (Figure 2).

A comparison of permit limits of BOD and ammonia nitrogen to historical BOD and ammonia nitrogen effluent concentrations from self-reported data provides historical con-

firmation of permit non-compliance for several municipal wastewater facilities in the Arroyo Colorado watershed during the same period. Although marked improvements in permit compliance have been observed since 1999, some facilities continue to exceed the effluent limits specified in their discharge permits.

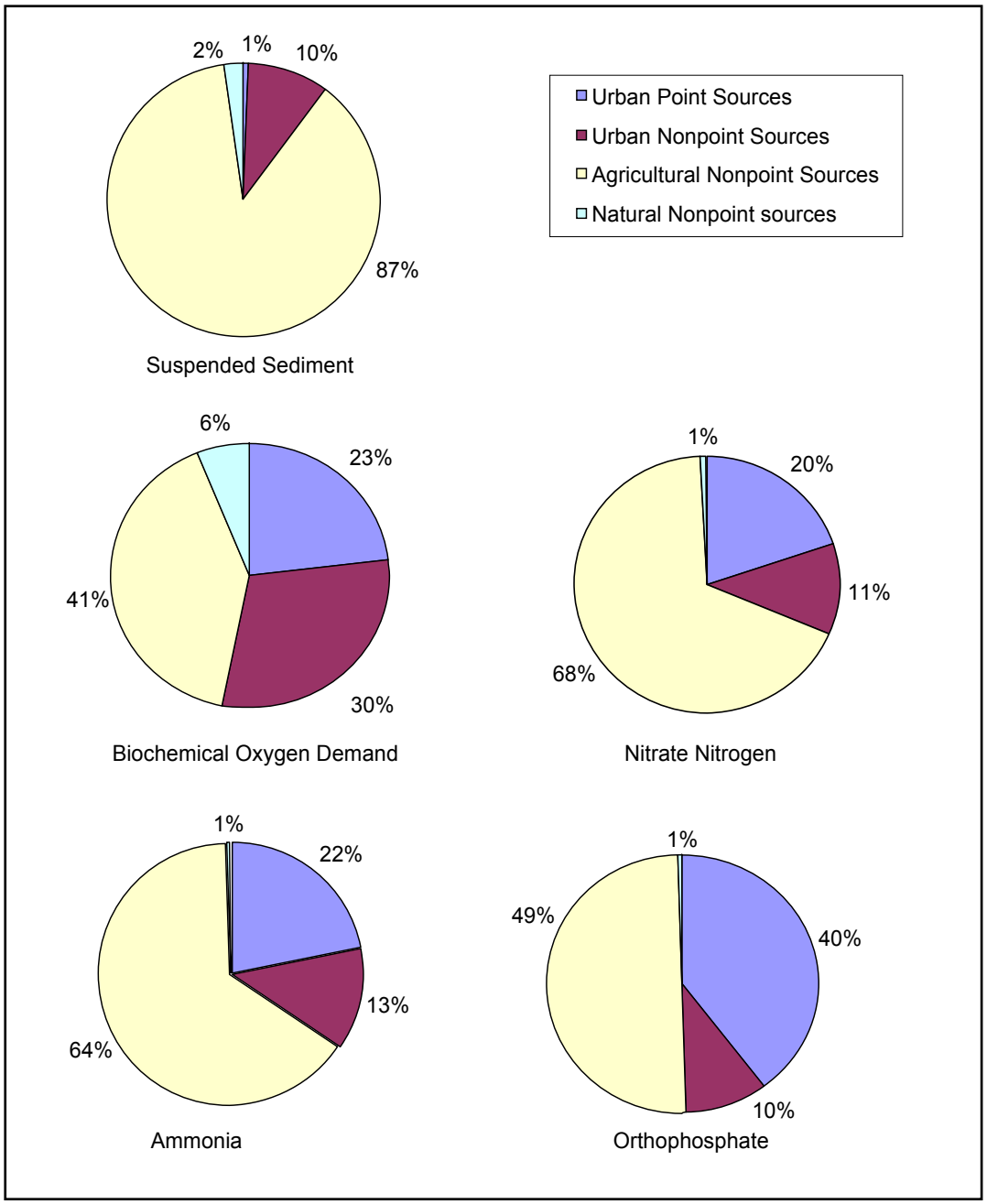

Figure 2. Percentage loading of selected constituents into the upper portion of Segment 2201 by source. Charts represent total loadings of each constituent between1989 and 1999 as estimated using Arroyo Colorado HSPF watershed model simulations (TCEQ 2003.)

Table 1. Active wastewater discharge permits in the Arroyo Colorado

Facility Name	Segment	TPDES Permit No.	Discharge Type	Permitted Flow (MGD)
Central Power & Light Bates Facility	2202	WQ0001254-000	Industrial	2
Central Power & Light La Palma Facility	2202	WQ0001256-000	Industrial	1.12
Frontera Generations Ltd.	2202	WQ0004051-000	Industrial	1.24
City of Mercedes	2202	WQ0010347-001	Municipal	2.3
City of San Benito	2202	WQ0010473-002	Municipal	2.16
City of Mission	2202	WQ0010484-001	Municipal	9.0
Harlingen Water Works Facility No. 1	2202	WQ0010490-002	Municipal	3.1
Harlingen Water Works Facility No. 2	2202	WQ0010490-003	Municipal	7.5
City of Donna	2202	WQ0010504-001	Municipal	2.7
City of Pharr	2202	WQ0010596-001	Municipal	5.0
City of Weslaco South Plant	2202	WQ0010619-005	Municipal	2.5
McAllen PUB Facility No.2	2202	WQ0010633-003	Municipal	10.0
City of La Feria	2202	WQ0010697-001	Municipal	0.5
Palm Valley Estates	2202	WQ0010972-002	Domestic (irrigation)	0.28
City of Hidalgo	2202	WQ0011080-001	Municipal	0.41
City of San Juan	2202	WQ0011512-001	Municipal	4.0
Winter Garden Park Assoc.	2202	WQ0011628-001	Domestic	0.011
Harlingen Consolidated ISD Wilson Elementary	2202	WQ0011659-001	Domestic (Irrigation)	0.006
Military Hwy Water Supply Corporation (Progreso)	2202	WQ0013462-001	Municipal	0.4
Military Hwy Water Supply Corporation (La Paloma)	2202	WQ0013462-002	Domestic (Irrigation)	0.21
Military Hwy Water Supply Corporation (Santa Maria)	2202	WQ0013462-003	Domestic (Irrigation)	0.23
Military Hwy Water Supply Corporation (San Pedro)	2202	WQ0013462-004	Domestic (Irrigation)	0.16
Military Hwy Water Supply Corporation (Los Indios)	2202	WQ0013462-005	Domestic (Irrigation)	0.135
La Joya ISD La Joya Elementary	2202	WQ0013523-001	Domestic (Subsurface Pressure)	0.15
La Joya ISD Chapa Elementary	2202	WQ0013523-002	Domestic (Subsurface Drain Field)	0.15
La Joya ISD Kika De la Garza Elementary	2202	WQ0013523-003	Domestic (Subsurface Pressure)	0.15
La Joya ISD 11^{th} and 12^{th} Elementary	2202	WQ0013523-004	Domestic (Subsurface Pressure)	0.15
City of Alamo	2202	WQ0013633-001	Municipal	2.0
Donna ISD Runn Elementary	2202	WQ0013680-001	Municipal	0.017

Table 1 (continued). Active wastewater discharge permits in the Arroyo Colorado

Facility Name	Segment	TPDES Permit No.	Discharge Type	Permitted Flow (MGD)
Donna ISD Muñoz Elementary	2202	WQ0013680-002	Domestic (Subsurface Drain Field)	0.0125
Donna ISD Garza Elementary	2202	WQ0013680-003	Domestic (Subsurface Drain Field)	0.0125
Mission CISD Mission Elementary	2202	WQ0013887-001	Domestic (Subsurface Drain Field)	0.013
USDA Moore Field WWTP	2202	WQ0014155-001	Domestic (Subsurface Drain Field)	0.0033
Taiwan Shrimp Village Assoc. and Arroyo Aquaculture Inc.	2201	WQ0003596-000	Industrial	100
Southern Star Inc.	2201	WQ0004244-000	Industrial	50
City of Rio Hondo	2201	WQ0010475-002	Municipal	0.4
Military Hwy Water Supply Corporation (Lago)	2201	WQ0013462-008	Municipal	0.51

Small Domestic Wastewater Systems

During the TMDL development process, The TCEQ categorized, inventoried, assessed and modeled domestic wastewater systems in the Arroyo Colorado watershed in accordance with the type of treatment and discharge mechanism associated with each system. In the absence of self-reported data, higher capacity systems, such as the large municipal wastewater treatment systems included in Table 1, were modeled according to the permitted flow and concentration of nutrients and BOD expected in the treated effluent based on the treatment type.

For the purpose of the Arroyo Colorado TMDL analysis, the TCEQ defined domestic wastewater systems as low capacity (< 0.35 MGD) wastewater systems with treatment mechanisms ranging from basic underground settling tanks with drain fields (i.e., on-site treatment systems) to low-flow systems with more advanced primary treatment including aeration basins, clarifiers and aerobic digesters. In addition to the relatively low volume of wastewater produced, domestic wastewater systems are also typically characterized by indirect (or no) discharges to surface waters. The indirect discharge mechanisms associated with these systems were modeled according to permit specifications (i.e., size of subsurface drain/pressure field, acreage irrigated, etc.)

Onsite Treatment Systems and Colonias

The TCEQ modeled individual onsite treatment systems in the Arroyo Colorado watershed using population figures and Geographic information System (GIS) coverages and shape files provided by the TWDB and the Lower Rio Grande Valley Development Council for areas in the watershed served by these systems. To model loadings to the Arroyo Colorado, the TCEQ used total population figures and GIS data along with assump-

tions regarding the average volume of wastewater produced per capita (100 gal/day), average size of most septic drain fields (1200 ft^2), and average concentrations of constituents found in wastewater from septic systems.

The TCEQ modeled loading of nutrients and BOD into the Arroyo Colorado from colonias in a similar fashion to that of onsite treatment systems. The TCEQ used colonia population figures and GIS coverages obtained from the TWDB along with assumptions regarding per capita wastewater production (100 gal/day), disposal areas (600 ft^2), and effluent quality to model daily loading of nutrients and BOD to the Arroyo Colorado. However, wastewater application for colonias was assumed to be a surface process and the wastewater volume and pollutant concentrations used in the watershed model were assumed to be that of essentially raw, untreated wastewater applied to the standard disposal areas.

Urban Storm Water

The TCEQ characterized ccontributions of nutrients, BOD, fecal bacteria, and suspended solids from urban storm water in the Arroyo Colorado Watershed and included these loading estimates in the TMDL analysis. A lack of area-specific storm water quality data forced the use of accumulation and export rates estimated from published values of event mean concentrations measured for similar urban land use categories in other metropolitan areas of Texas. It should be noted that the "Urban Nonpoint Source" category shown in Figure 2 includes urban storm water from pervious and impervious cover which includes loading from colonias included within a city's CCN. Supplying centralized wastewater service to colonia residents, therefore, represents a reduction in overall loading of BOD and nutrients to the Arroyo Colorado.

Phase II of the Federal and State storm water regulations requires all municipalities in the Arroyo Colorado watershed that are located within U.S. Census Bureau defined "Urbanized Areas" to obtain coverage under a TPDES permit and to develop Storm Water Management Programs (SWMPs). All Phase II SWMPs will be reviewed by the TCEQ for compliance with TPDES storm water regulations. As part of the Arroyo Colorado PRP, the TCEQ will review SWMPs for Urbanized Areas in the Arroyo Colorado watershed and use these documents to evaluate an area's ability to control contributions of pollutants of concern to the Arroyo Colorado (e.g. nutrients, BOD, sediment, and fecal pathogens). The TCEQ's Storm Water & Pretreatment Team will conduct these evaluations in coordination with the TCEQ's TMDL program. The evaluations will take into account economic considerations, as the standard is set at reducing pollution to the "maximum extent practicable."

In 2002, the major municipalities in the Rio Grande Valley, in partnership with Texas A&M - Kingsville, created The Lower Rio Grande Valley TPDES Storm Water Task Force (LRGV–TPDES Task Force). The purpose of the LRGV–TPDES Task Force is to facilitate compliance with all aspects of Federal and State Phase II storm water regulations. The first two years of efforts by the LRGV–TPDES Task Force have focused on outreach and education to familiarize the cities in the Rio Grande Valley with the requirements of the regulations. However, beginning in 2006, the LRGV–TPDES Task

Force will begin developing SWMPs for municipalities in the Rio Grande Valley including those located in the Arroyo Colorado watershed. To a large extent, these plans will be tailored to control contributions of pollutants of concern to the Arroyo Colorado.

In addition to the work of the TPDES Storm Water Task Force, the TCEQ is funding an important demonstration project in the Rio Grande Valley to implement and showcase composting technology for reducing fertilizer and pesticide use by businesses and private citizens. The project, known as Texas Greenscapes, is being funded with a Federal CWA §319 grant and has the objective of reducing pollutants in urban storm water runoff. The project also has strong outreach and education components designed to promote the use of compost to reduce storm water pollution.

LOAD REDUCTION MEASURES

Because only 23 of the 38 discharge permits presented in Table 1 have direct outfalls into the Arroyo Colorado or to drainage ditches that flow into the Arroyo and because of the low levels of pollutants and/or infrequent discharge from the five industrial dischargers, including the two aquaculture facilities listed in Table 1, the remaining 18 (municipal) wastewater treatment facilities account for over 95% of the total permitted point source loading of pollutants entering the Arroyo Colorado.

The TCEQ's efforts to reduce loading of pollutants into the Arroyo Colorado from wastewater discharges must include mitigation of as many of these sources as possible. However, because of limited resources, the TCEQ will focus initial planning efforts on controlling the principal contributors of pollutants to the impaired portion of the Arroyo Colorado. Accordingly, the sources which are the focus of this plan are the 18 facilities listed in Table 2. The geographic location of these 18 facilities is shown in Figure 3. The following sections provide a description of each facility shown in Table 2, the load reduction measures implemented at each facility since the year 2000 and the various load reduction measures that will be implemented to reduce loadings of pollutants through the year 2015.

Institutional Controls

Since the year 2000, many of the wastewater treatment facilities considered to be the principal point source contributors of pollutants of concern to the Arroyo Colorado have realized reductions in loadings as a result of reductions in the effluent concentrations specified in discharge permits issued under the State's Texas Pollution Discharge Elimination System (TPDES). As of the date of publication of this document, only four of the facilities shown in Table 2 have discharge permits allowing pond and lagoon treatment systems with effluent concentrations of 30 mg/l of BOD5 and 90 mg/l of total suspended solids (TSS). These types of permits, commonly referred to as 30/90 permits, represent the most basic treatment required of centralized wastewater treatment systems under the TPDES program.

The first priority of this plan is to eliminate 30/90 permits in the Arroyo Colorado watershed by the year 2010. Most of the treatment levels of the remaining facilities in Table 2

Table 2. Principal point source contributors of pollutants of concern to the Arroyo Colorado

Facility Name	Segment	TPDES Permit No.	Discharge Type	Permitted Flow (MGD)
City of Mercedes	2202	WQ0010347-001	Municipal	2.3
City of San Benito	2202	WQ0010473-002	Municipal	2.16
City of Rio Hondo	2201	WQ0010475-002	Municipal	0.4
City of Mission	2202	WQ0010484-001	Municipal	9.0
City of Harlingen Plant No. 1	2202	WQ0010490-002	Municipal	3.1
City of Harlingen Plant No. 2	2202	WQ0010490-003	Municipal	7.5
City of Donna	2202	WQ0010504-001	Municipal	2.7
City of Pharr	2202	WQ0010596-001	Municipal	5.0
City of Weslaco South Plant	2202	WQ0010619-005	Municipal	2.5
City of McAllen Plant No.2	2202	WQ0010633-003	Municipal	10.0
City of La Feria	2202	WQ0010697-001	Municipal	0.5
City of Hidalgo	2202	WQ0011080-001	Municipal	0.41
City of San Juan	2202	WQ0011512-001	Municipal	4.0
Military Hwy Water Supply Corporation (Progreso)	2202	WQ0013462-001	Municipal	0.4
Military Hwy Water Supply Corporation (Balli Rd., South Alamo)	2202	WQ0013462-006	Municipal	0.51
Military Hwy Water Supply Corporation (Lago)	2201	WQ0013462-008	Municipal	0.51
City of Alamo	2202	WQ0013633-001	Municipal	2.0
East Rio Hondo Water Supply Corporation	2201	WQ0014558-001	Municipal	0.16

are to achieve 20 mg/l BOD5 and 20 mg/l TSS (20/20 permits). The second priority of this plan is to transition all 20/20 facilities shown in Table 2 to treatment levels of 10 mg/l BOD5 and 15 mg/l TSS (10/15) or lower by the year 2015. Nine of the facilities shown in Table 2 are currently at this (10/15) treatment level. Table 3 shows a comparison of current and proposed effluent sets for the 18 principal point source contributors of pollutants of concern to the Arroyo Colorado.

Historical and projected increases in permitted effluent flows at many of the wastewater treatment facilities shown in Table 2 do not necessarily result in an overall increase in loading to the Arroyo Colorado despite the fact that treatment levels for some of these facilities may remain unchanged through the year 2015. This is because much of the increase in treated effluent from these facilities represents a mitigation of untreated or poorly treated wastewater which would ordinarily enter the Arroyo Colorado from colonias and failing septic systems.

Table 3 summarizes the historical and projected TPDES permit actions issued since the year 2000 and expected through the year 2015. More detailed descriptions of each permit action included in the plan are presented in the following sections.

The year 2000 was chosen as the starting benchmark for load calculations because many of the wastewater infrastructure improvements projects implemented in the Arroyo Colorado watershed under the TWDB's Economically Distressed Area Program (EDAP) and

other similar programs reached completion only after 1999. Also, Phase I of the Arroyo Colorado TMDL project began in 1998 and was completed in 2002.

Figure 3. Principal point source contributors of pollutants of concern to the Arroyo Colorado

History of Wastewater Discharge Permits (2000-2005)

In the period of 2000 through 2005, three wastewater facilities were upgraded and two new facilities were built in the Arroyo Colorado watershed. These and other changes in discharge permits resulted in an increase in permitted wastewater flow of 9.6 MGD within this period. All changes in permitted effluent flows for wastewater treatment facilities in the watershed are summarized in the following paragraphs for the period of 2000-2005.

City of San Juan

In 2001, the TCEQ amended the wastewater discharge permit for the City of San Juan, reducing the allowable wastewater effluent concentrations from 20/20 to 10/15 and placing a limit of 3 mg/l on the concentration of ammonia nitrogen (NH3-N) in the city's wastewater effluent (10/15/3). The amendment also increased the allowable wastewater discharge from 1.15 MGD to 4.0 MGD. While this permit action represents an increase in the permitted load of BOD5 from this facility of approximately 43% (from 192 lbs/day to 334 lbs/day), an increase in the loading of TSS of approximately 62% (from 192 lbs/day to 500 lbs/day), and an increase in the loading of NH3-N of approximately 62% (from an estimated 38 lbs/day to 100 lbs/day), the TCEQ estimates the increases in permitted load-

ing are offset by the mitigation of loadings from untreated or poorly treated wastewater from 4939 residents in 24 colonias connected to the City of San Juan's wastewater collection system in 2003.

Table 3. Summary of historical and projected changes in discharge permits in the Arroyo Colorado from January 2000 through December 2015.

Facility Name	TPDES Permit No.	Old Flow (MGD) and Effluent Set (mg/l) BOD5/TSS/NH3-N	New Flow (MGD) and Effluent Set (mg/l) BOD5/TSS/NH3-N	Year of Permit Action
City of San Juan	WQ0011512-001	(1.15) 20/20/NA	(4.0) 10/15/3	2001
Military Highway Water Supply Corporation (Lago)	WQ0013462-008	NA	(0.5) 20/20/3	2001
City of Hidalgo	WQ0011080-001	(0.41) 30/90/NA	(1.2) 10/15/3	2002
City of San Benito	WQ0010473-002	(2.16) 30/30/NA	(2.5) 10/15/3	2004
City of Weslaco	WQ0010619-005	(2.0) 10/15/3	(2.5) 10/15/3	2005
City of Mission	WQ0010484-001	(4.6) 10/15/3	(9.0) 10/15/2	2005
East Rio Hondo Water Supply Corporation	WQ0014558-001	NA	(0.16) 10/15/3	2005
City of Rio Hondo*	WQ0010475-002	(0.4) 20/20/NA	(0.4) 20/20/NA	2006
Harlingen Water Works Plant No. 1	WQ0010490-002	(3.1) 20/20/NA	(3.1) 10/15/3	2006
City of La Feria	WQ0010697-001/2	(0.5) 30/90/NA	(1.25) 10/15/3	2006
Military Highway Water Supply Corporation (Progreso)	WQ0013462-001	(0.4) 30/90/NA	(0.75) 10/15/3	2007
City of Donna*	WQ0010504-001	(2.7) 20/20/NA	(3.0) 10/15/3	2007
City of Alamo	WQ0013633-001	(2.0) 30/90/NA	(2.5) 10/15/3	2007
City of Pharr	WQ0010596-001	(5.0) 10/15/3	(8) 7/12/2	2007
City of Hidalgo	WQ0011080-001	(1.2) 10/15/3	(1.4) 10/15/3	2007
City of San Benito	WQ0010473-002	(2.5) 10/15/3	(3.75) 10/15/3	2007
City of Rio Hondo	WQ0010475-002	(0.4) 20/20/NA	(0.65) 10/15/3	2010
City of Mercedes	WQ0010347-001	(2.3) 10/15/3	(3.2) 10/15/3	2010
East Rio Hondo Water Supply Corporation	WQ0014558-002	NA	(0.16) 10/15/3	2012
City of Mission	WQ0010484-001	(9.0) 10/15/2	(13.5) 10/15/2	2014

NA signifies that no limit is applicable.

*Amendment includes increase in minimum DO effluent concentration from 2.0mg/l to 4.0 mg/l

Military Highway Water Supply Corporation (MHWSC) - Lago

In 2001, the TCEQ issued a new wastewater discharge permit to the Military Highway Water Supply Corporation (MHWSC) for a new wastewater treatment facility with an allowable effluent flow of 0.51 MGD at effluent concentrations of BOD5, TSS, and NH3-N of 20/20/3, respectively. The permit action represents an increase in the permitted loading of BOD5, TSS, and NH3-N from this facility of 85 lbs/day, 85 lbs/day, and 13 lbs/day, respectively. The outfall for this new wastewater treatment facility flows into a drainage ditch located 13 miles south of the Arroyo Colorado. The new facility will provide central-

ized treatment of wastewater to 246 colonia residents in the Lago area south of San Benito. The TCEQ estimates the increase in permitted loading is offset by the mitigation of loadings from untreated or poorly treated wastewater from the Lago colonia.

City of Hidalgo

In 2002, the TCEQ issued a permit amendment to the City of Hidalgo reducing the allowable wastewater effluent concentrations of BOD5 and TSS from 30/90 to 10/15 and placing a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3). The amendment for this facility upgrade also increased the allowable wastewater discharge from 0.41 MGD to 1.2 MGD. This permit action represents a decrease in the permitted loading of BOD5 from this facility operator of approximately 2% (from 102 lbs/day to 100 lbs/day), a decrease in the permitted loading of TSS of about 51% (from 306 lbs/day to 150 lbs/day), and an increase in the permitted loading of NH3-N of 31% (from an estimated 20 lbs/day to 30 lbs/day.) The TCEQ estimates the increase in the permitted loading of NH3-N is offset by the mitigation of loadings from untreated or poorly treated wastewater from 1582 colonia residents connected to the City of Hidalgo's wastewater collection system in 2002 and 2003.

City of San Benito

In 2004, the TCEQ issued a new permit to the City of San Benito reducing the allowable wastewater effluent concentrations of BOD5 and TSS from 30/30 to 10/15 and placing a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3). The new permit also increases the allowable wastewater discharge by the City of San Benito from 2.16 MGD to 2.5 MGD. This permit action represents a decrease in the permitted load of BOD5 from this facility operator of 61% (from 540 lbs/day to 209 lbs/day), a decrease in the permitted load of TSS of 42% (from 540 lbs/day to 313 lbs/day) and a decrease in the load of NH3-N of 23% (from an estimated 108 lbs/day to 72 lbs/day.) These reductions are expected to take effect in 2006.

City of Weslaco

In 2005, the TCEQ issued a permit amendment to the City of Weslaco increasing the allowable wastewater effluent flow from 2.0 MGD to 2.5 MGD at effluent concentrations of BOD5, TSS, and NH3-N of 10/15/3 respectively. The increase in effluent flow at the City of Weslaco's wastewater treatment facility is expected to occur in 2006. This permit action represents an increase in the permitted load of BOD5 from this facility to the Arroyo Colorado of approximately 20% (from 167 lbs/day to 209 lbs/day), an increase in the loading of TSS of approximately 20% (from 250 lbs/day to 315 lbs/day) and an increase in the loading of NH3-N of approximately 21% (from an estimated 50 lbs/day to 63 lbs/day). This permit action was necessary to accommodate the increase in flow to the city's wastewater treatment facility from new wastewater service provided to 6276 colonia residents.

City of Mission

In 2005, the TCEQ issued a permit amendment to the City of Mission increasing the allowable effluent flow from 4.6 MGD to 9.0 MGD at BOD and TSS effluent concentra-

tions of 10/15, respectively. The permit amendment reduced allowable wastewater effluent concentrations of NH3-N from 3 mg/l to 2 mg/l. However, the permit amendment represents an increase in loading of BOD5 and TSS from this facility to the Arroyo Colorado of 49% and an increase in loading of ammonia nitrogen of 24% from the increased effluent flow in the outfall. This amendment was necessary to accommodate the increase in the flow of wastewater reaching the treatment facility from new wastewater service provided to 1711 colonia residents between 1996 and 2000 (Linda Vista, Madero, and Granjeno) and an estimated 7300 colonia residents living in the Northern part of the City of Mission's Certificate of Convenience and Necessity area (North Mission CCN) in 2006. The TCEQ estimates the increase in permitted loading is offset by the mitigation of loadings from untreated or poorly treated wastewater from connected colonias.

East Rio Hondo Water Supply Corporation (ERHWSC)

In 2005, the TCEQ issued a permit to the East Rio Hondo Water Supply Corporation for a new wastewater treatment facility with an allowable effluent flow from 0.16 MGD at BOD5, TSS and NH3-N effluent concentrations of 10/15/3 respectively. The permit action represents an increase in permitted loading of BOD5, TSS, and NH3-N to the Arroyo Colorado of 13 lbs/day, 20 lbs/day and 2 lbs/day respectively. The outfall for this new treatment facility flows into the Arroyo Colorado below the zone of impairment and only after traveling through 7.2 miles of drainage ditches. The new permit will allow centralized treatment of wastewater for 525 colonia residents living in the Las Yescas, and the Lozano colonia communities in 2006 and an additional 1050 colonia residents which will be connected between 2006 and 2009 (i.e., residents of Lantana, San Vicente, and La Tina Ranch, Floresville, and Arroyo Gardens.) The TCEQ estimates the increase in permitted point source loading into the discharge ditch flowing into the Arroyo Colorado below the zone of impairment is offset by the mitigation of loadings from untreated or poorly treated colonia wastewater.

Near-Term Wastewater Discharge Permits (2006-2010)

In the period of 2006 through 2010, five existing wastewater treatment facilities plan upgrades or expansions and five new facilities are planned in the Arroyo Colorado watershed. These and other changes in discharge permits will result in an increase in permitted wastewater flow of 6.2 MGD within this period. All projected changes in permitted effluent flows for wastewater treatment facilities in the watershed are summarized in the following paragraphs for the period of 2006-2010.

City of Rio Hondo

In 2006, the TCEQ will amend the wastewater discharge permit for the City of Rio Hondo to require an increase in the concentration of DO in the city's wastewater effluent from the present 2.0 mg/l to 4.0 mg/l. This permit action will help to mitigate DO problems in the Arroyo Colorado's zone of impairment.

Harlingen Water Works System (HWWS)

In 2007 the TCEQ plans to issue a permit action designed to improve wastewater treatment at Harlingen Waterworks System's (HWWS') Wastewater Facility No. 1. The per-

mit action will reduce the allowable wastewater effluent concentrations of BOD5 and TSS from the current 20/20 to 10/15 and will place a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3). In the interim, HWWS plans to complete a feasibility study (e.g., Comprehensive Wastewater Master Plan) to improve wastewater collection and treatment in the entire area specified in the HWWS Certificate of Convenience and Necessity (CCN). The study includes plans to evaluate the overall state of wastewater treatment in HWWS' CCN and to recommend improvements to the wastewater system. The results of the Comprehensive Wastewater Master Plan may render the permit action described above unnecessary. However, regardless of the outcome of HWWS' Comprehensive Wastewater Master Plan, the TCEQ expects the influent currently reaching HWWS' Wastewater Treatment Facility No. 1 to be treated to concentrations of no greater than 10 mg/l BOD5, 15mg/l TSS, and 3.0 mg/l NH3-N before being discharged to the Arroyo Colorado. This expectation represents a decrease in the permitted load of BOD5 from this facility of 50% (from 517 lbs/day to 258 lbs/day), a decrease in the permitted load of TSS of 25% (from 517 lbs/day to 388 lbs/day) and a decrease in the load of NH3-N of 24% (from an estimated 103 lbs/day to 78 lbs/day.) The TCEQ expects these reductions to take effect in 2009.

City of La Feria

In 2006, the TCEQ will issue a new wastewater discharge permit to the City of La Feria reducing the allowable wastewater effluent concentrations of BOD5 and TSS from 30/90 to 10/15 and will place a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3). The permit action will include expansion of effluent flow from the current 0.5 MGD to 1.25 MGD. This permit action represents a decrease in the permitted loading of BOD5 from this facility operator of 17% (from 125 lbs/day to 104 lbs/day), a decrease in the permitted loading of TSS of 59% (from 375 lbs/day to 156 lbs/day), and an increase in the loading of NH3-N of 19% (from an estimated 25 lbs/day to 31 lbs/day). The TCEQ estimates the increase in the permitted loading of NH3-N is offset by the mitigation of loadings from untreated or poorly treated wastewater from 2185 colonia residents who will be connected to the City of La Feria's wastewater collection system in 2006.

MHWSC - Progreso

In 2006, the MHWSC will apply for an amendment to the current wastewater discharge permit to replace the existing wastewater treatment facility serving the city of Progreso. Preliminary designs for the facility are for treatment levels of BOD5, TSS, and NH3-N of 20/20/4 respectively. However, with available funding, this design will be modified to achieve treatment levels of BOD5, TSS, and NH3-N of 10/15/3, respectively. The TCEQ expects to issue the permit amendment in 2007 reducing the allowable wastewater effluent concentrations of BOD5 and TSS of 30/90 at this current facility to 10/15 for the new facility. If funding is made available, the TCEQ will also place a limit of 3 mg/l on the concentration of NH3-N allowed in the water supply corporation's wastewater effluent (10/15/3). The amendment will also increase the MHWSC's allowable wastewater discharge from 0.4 MGD to 0.75 MGD. This permit action represents a decrease in the permitted loading of BOD5 from this facility operator of 38% (from 100 lbs/day to 62 lbs/day), a decrease in the permitted loading of TSS of 69% (from 300 lbs/day to 94

lbs/day) and a decrease in the permitted loading of NH3-N of 5% (from 20 lbs/day to 19 lbs/day). These reductions are expected to take effect in 2008.

City of Donna

In 2006, The City of Donna will apply for an amendment to the city's current wastewater discharge permit for a planned upgrade to the existing wastewater treatment facility. The upgrade will include an expansion of effluent flow from the 2.7 MGD of the current facility to 3.0 MGD for the upgraded facility. The TCEQ expects to issue a permit in 2007 reducing the allowable wastewater effluent concentrations of BOD5 and TSS from the current 20/20 to 10/15 and placing a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3) and increasing the DO levels required in the treated effluent from the current 2.0 mg/l to 4.0 mg/l. The permit action will reduce BOD5 from this facility by 44% (from 450 lbs/day to 250 lbs/day), TSS by 17% (from 450 lbs/day to 375 lbs/day) and NH3-N of 33% (from an estimated 100 lbs/day to 75 lbs/day.) These reductions are expected to take effect in 2008.

City of Alamo

In 2006, the City of Alamo will apply for a new wastewater discharge permit for a new wastewater treatment facility planned for construction in 2007. The new facility will increase the city's effluent flow from the current 2.0 MGD to 2.5 MGD. The TCEQ expects to issue a permit in 2007 reducing the allowable wastewater effluent concentrations of BOD5 and TSS from the current 30/90 to 10/15 and placing a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3). The permit action will decrease BOD5 loading from this facility operator by 59% (from 500 lbs/day to 208 lbs/day), decrease TSS loading by 79% (from 1500 lbs/day to 313 lbs/day), and decrease NH3-N loading by 37% (from an estimated 100 lbs/day to 63 lbs/day.) These reductions are expected to take effect in 2008.

City of Pharr

In 2006, the City of Pharr will apply for a permit amendment to increase the flow of effluent from their treatment facility from the current 5 MGD to 8 MGD. The TCEQ expects to issue a permit amendment in 2007 reducing the allowable wastewater effluent concentrations of BOD5 and TSS from the current 10/15 to 7/12 and lowering the concentration of NH3-N to 2 mg/l (DO limit of 6.0 mg/l). The permit action will allow the amount of permitted effluent flow to the Arroyo Colorado from the City of Pharr to increase while only slightly increasing the permitted load of BOD5, TSS, and NH3-N. Additionally, the TCEQ will grant the permit amendment on condition that the city will include nutrient removal as part of the treatment system (tertiary treatment with denitrification and P removal or post treatment wetland cells/polishing ponds.) The permit action will increase the permitted load of BOD5 from this facility to the Arroyo Colorado by approximately 12% (BOD5 from 417 lbs/day to 466 lbs/day), TSS by 20% (from 625 lbs/day 800 lbs/day) and NH3-N by 8% (from 125 lbs/day to 133 lbs/day). The increase in permitted effluent flow is necessary to accommodate the increase in wastewater to the City of Pharr's collection system from new wastewater service, which will be provided to 2271 colonia residents in 2006-2007 (i.e., Las Milpas II).

City of Hidalgo

In 2006, the City of Hidalgo will apply for a permit amendment to increase the flow of effluent from the city's treatment facility from 1.2 MGD to 1.4 MGD at the current wastewater effluent concentrations of BOD5, TSS and NH3-N of 10/15/3, respectively. The TCEQ expects to issue the permit amendment in 2007 on condition that the city will include nutrient removal as part of the treatment system (tertiary treatment with denitrification and P removal or post treatment wetland cells/polishing ponds.) The permit action will increase the permitted load of BOD5, TSS and NH3-N from this facility to the Arroyo Colorado by approximately 14% (BOD5 from 100lbs/day to 117 lbs/day, TSS from 150 lbs/day 175 lbs/day and NH3-N from 30 lbs/day to 35 lbs/day). The city must increase effluent flow from their wastewater treatment facility to accommodate new wastewater service to 600 colonia residents scheduled for connection in 2006.

City of San Benito

In 2007, the City of San Benito will apply for an additional permit amendment to increase the flow of effluent from the city's treatment facility from 2.5 MGD to 3.75 MGD at the current permitted BOD5, TSS and NH3-N wastewater effluent concentrations of 10/15/3, respectively. The TCEQ expects to issue a permit amendment in 2007 on condition that the city build an accompanying post-treatment wetland cells/polishing pond system. The permit action will increase the permitted load of BOD5, TSS from this facility to the Arroyo Colorado by approximately 50% from 2006 levels (BOD5 from 209 lbs/day to 313 lbs/day, TSS from 313 lbs/day 469 lbs/day and NH3-N from 63 lbs/day to 94 lbs/day). The city must increase effluent flow from their wastewater treatment facility to accommodate additional flow of wastewater from colonia connections.

Long-Term Wastewater Discharge Permits (2011-2015)

In the period of 2011 through 2015, three existing wastewater treatment facilities plan upgrades or expansions and one new facility is planned in the Arroyo Colorado watershed. These and other changes in discharge permits will result in an increase in permitted wastewater flow of 5.8 MGD within this period. All projected changes in permitted effluent flows for wastewater treatment facilities in the watershed are summarized in the following paragraphs for the period of 2011-2015.

City of Mercedes

In 2009 the City of Mercedes will apply for a permit amendment to increase the flow of effluent from their wastewater treatment facility from 2.3 MGD to 3.2 MGD at the current wastewater effluent concentrations of BOD5, TSS and NH3-N of 10/15/3, respectively. The TCEQ expects to issue the permit amendment in 2010 or 2011 on condition that the city will include nutrient removal as part of the treatment system (tertiary treatment with denitrification and P removal or post treatment wetland cells/polishing ponds.) The permit action will increase permitted BOD5 and TSS loadings from this facility to the Arroyo Colorado by 39% (from 192 lbs/day to 267 lbs/day for BOD5 and from 288 lbs/day to 400 lbs/day for TSS), and will increase NH3-N loading by 40% (from 57 lbs/day to 80 lbs/day). The permit action will allow centralized treatment of wastewater from 446 households (approximately 1561 residents) located in the La Meza Subdivision

and 10 additional colonias scheduled to be connected to the city's wastewater collection system between 2007 and 2010. The TCEQ estimates the increase in permitted loading is offset by the mitigation of loadings from untreated or poorly treated wastewater from the colonias scheduled for connection.

City of Rio Hondo

In 2010, the City of Rio Hondo will apply for a permit amendment to increase the flow of effluent from 0.4 MGD to 0.65 MGD at the city's wastewater treatment facility. The TCEQ expects to issue a permit amendment in 2010 or 2011 reducing the allowable wastewater effluent concentrations of BOD5 and TSS from the current 20/20 to 10/15 and placing a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3). The permit action will decrease BOD5 loading from this facility to the Arroyo Colorado by 19% (from 67 lbs/day to 54 lbs/day); will increase TSS loading from this facility to the Arroyo Colorado by 21% (from 67 lbs/day to 81 lbs/day), and will decrease NH3-N loading from this facility to the Arroyo Colorado by 25% (from an estimated 22 lbs/day to 16 lbs/day.) The reductions are expected to take effect in 2011.

ERHWSC – Arroyo City

In 2011, the ERHWSC plans to apply for a wastewater discharge permit for a new lagoon and constructed wetland wastewater treatment facility targeted for construction near Arroyo City in 2013. The treatment facility will be designed to treat wastewater generated by existing colonias and communities with failing septic systems located on the east side of Arroyo City. The TCEQ expects to issue a permit for the new 0.16 MGD facility in 2012. Required treatment levels of BOD5, TSS and NH3-N will be at or below 10/15/3, respectively. The permit action will increase BOD5 loading to the Arroyo Colorado by 13 lbs/day, TSS loading by 20 lbs/day, NH3-N loading by 4 lbs/day. The increases in loading to the Arroyo Colorado are expected to be partially offset by the mitigation of NPS loadings from the connected colonias and septic systems. The outfall for the new wastewater treatment facility described above will likely be located downstream of the zone of impairment in the Arroyo Colorado.

City of Mission

In 2013, the City of Mission will apply for an additional permit amendment to increase the flow of effluent from the city's treatment facility from 9.0 MGD to 13.5 MGD. The TCEQ expects to issue the permit amendment in 2014 with reduced effluent limitations (7/12/1) and on condition that the city will include nutrient removal as part of the treatment system (tertiary treatment with denitrification and P removal or post treatment wetland cells/polishing ponds.) The permit action will increase the permitted load of BOD5 from this facility to the Arroyo Colorado by 5 % (from 751 lbs/day to 787 lbs/day) and the loading of TSS by 17% (from 1125 lbs/day 1350 lbs/day). However, the permit action will decrease the loading of NH3-N from this facility to the Arroyo Colorado by approximately 25% (from 150 lbs/day to 113 lbs/day). The City of Mission must increase effluent flow from their wastewater treatment facility to accommodate additional flow of wastewater from existing colonia connections and connections planned for an additional 45 colonias in the western portion of the city's CCN. The estimated population potentially served is 18,000 residents. Additionally, the facility expansion may also be needed

to accommodate additional flow of wastewater from wastewater connections being considered for several colonias located in east La Joya (13,750 residents).

Infrastructure Improvements

The wastewater infrastructure improvements described in this section reflect the load reduction measures undertaken by wastewater operators to reduced loadings of pollutants of concern to the Arroyo Colorado since the year 2000 and additional measures proposed through the year 2015. The measures include improvements in effluent quality resulting from increased treatment levels at existing and proposed wastewater treatment facilities and the reduction of loadings from domestic NPS through improved wastewater collection and secondary treatment of previously untreated or poorly treated wastewater from colonias and other existing unincorporated communities. Table 4 summarizes the historical and projected improvements in wastewater infrastructure occurring in the Arroyo Colorado watershed between the years 2000 and 2015. It is important to note that the estimated load reductions described in this section were calculated to reflect loadings at the point of origin and represent gross loading reductions. The estimated equivalent net loading reductions, which take into account the considerable natural attenuation that occurs during transport of sewage from colonias to the Arroyo Colorado, is presented in Table 7.

History of Infrastructure Improvements (2000-2005)

In the period of 2000 through 2005, 37,886 colonia residents were connected to centralized wastewater treatment services in the Arroyo Colorado watershed. These and other changes in infrastructure have resulted in the mitigation of 120,450 lbs/year of BOD, 96,360 lbs of TSS, 24,090 lbs/year of Ammonia Nitrogen, 60,2250 lbs/year of Total Nitrogen, and 5,110 lbs/year of Total Phosphorus from rural and suburban domestic sources of wastewater. All changes in wastewater infrastructure in the watershed are summarized in the following paragraphs for the period of 2000-2005.

HWWS (Harlingen Water Works System)

In 2000, the HWWS connected 947 colonia residents to the HWWS' wastewater collection system. The connected colonia residents live in the Arroyo Colorado Estates and Bishop-Leal Subdivisions. In 2003, HWWS completed wastewater collection system connections for an additional 5,435 colonia residents located in the municipality of Primera and the Census Designated Place (CDP) of Lasana. In 2004, HWWS completed wastewater collection system connections for another 233 colonia residents located in the Village of Santa Elena and the CDP of Laguna Escondida. Finally, in 2005, HWWS completed wastewater collection system connections for 2720 residents in the municipal ity of Combes. The connections reduced NPS loadings of BOD5 by 874 lbs/day, NH3-N by 175 lbs/day, total phosphorus (TP) by 37 lbs/day, and total nitrogen (TN) by 437 lbs/day.

City of Weslaco

In 2000, the City of Weslaco connected 348 colonia residents living in the Sun Country Estates subdivision to the city's wastewater collection system. In 2002, the city connected an additional 5,001 colonia residents, including Llano Grande, Agua Dulce, Los Casti

llos, Angela, Cuellar, Villa Verde, RC Babb, and Bellaire (I) Subdivisions. In 2003, the city connected an additional 773 colonia residents living in the Expressway Heights Subdivision, and in 2005, connected another 154 colonia residents living on south side of the Bellaire Subdivision (Bellaire II). The connections reduced NPS loadings of BOD5 by 654 lbs/day, NH3-N by 131 lbs/day, TP by 28 lbs/day, and TN by 327 lbs/day.

Table 4. Summary of historical and projected improvements in wastewater infrastructure in the Arroyo Colorado watershed in the period of 2000 through 2015

Wastewater Operator	Historical 2000-2005		Near-Term 2006-2010		Long-Term 2011-2015	
	NPS*	PS**	NPS*	PS**	NPS*	PS**
City of San Juan	4939	Facility Expansion/ Upgrade	1810	NA	4500	NA
Military Highway Water Supply Corporation (Lago)	246	New Facility	NA	NA	NA	NA
City of Hidalgo	1582	Facility Upgrade	600	Facility Expansion	NA	NA
City of San Benito	636	NA	NA	New Facility & Expansion	NA	NA
City of Weslaco	6276	NA	12,150	Facility Expansion	NA	NA
McAllen PUB	2386	NA	NA	NA	NA	NA
East Rio Hondo Water Supply Corporation	NA	NA	1575	New Facility	175	New Facility
City of Rio Hondo	328	NA	NA	Facility Expansion/ Upgrade	50	NA
Harlingen Water Works Wastewater Facility No.1	8388	NA	NA	Facility Upgrade	NA	NA
City of La Feria	NA	NA	2185	New Facility	NA	NA
Military Highway Water Supply Corporation (Balli Rd.)	2975	New Facility	NA	NA	NA	NA
Military Highway Water Supply Corporation (Progreso)	NA	NA	84	New Facility	NA	NA
City of Donna	NA	NA	5652	Facility Expansion/ Upgrade	3185	NA
City of Alamo	NA	NA	1167	New Facility	NA	NA
City of Pharr	8206	NA	2271	Facility Expansion/ Upgrade	NA	NA
City of Mission	1711	Facility Expansion/ Upgrade	25300	NA	NA	Facility Expansion/Upgrade
City of Mercedes	213	NA	5816	NA	1561	Facility Expansion/Upgrade
Totals	**37,886**	**5**	**58,610**	**11**	**7,910**	**3**

NA signifies the measure is not applicable

* Number of colonia residents provided centralized wastewater services

** Treatment facility changes

City of Rio Hondo

In 2001, the City of Rio Hondo connected 328 colonia residents to the city's wastewater collection system, reducing NPS loadings of BOD5 by 34 lbs/day, NH3-N by 6.8 lbs/day, TP by 1.4 lbs/day, and TN by 17 lbs/day.

MHWSC – Balli Rd.

In 2001, the MHWSC began providing new wastewater service to 2975 colonia residents in the South Tower Estates subdivision in the city of Alamo. The MHWSC accomplished this through the construction of a new wastewater treatment facility on Balli Road in South Alamo. The TPDES permit for this new facility was issued by the TCEQ in April of 1999. The connections reduced NPS loadings of BOD5 by 310 lbs/day, NH3-N by 62 lbs/day, TP by 13 lbs/day, and TN by 155 lbs/day.

MHWSC – Lago

Also in 2001, the MHWSC began providing new wastewater service to 246 colonia residents in the Lago area of the city of San Benito. The MHWSC accomplished this through the construction of a new wastewater treatment facility on Joines Road in Lago area of south San Benito. The connections reduced NPS loadings of BOD5 by 26 lbs/day, NH3-N by 5 lbs/day, TP by 1 lb/day, and TN by 13 lbs/day.

City of Hidalgo

In 2002 and 2003, the City of Hidalgo connected 1582 colonia residents to the city's wastewater collection system (including residences in Villa Garza, Grey Recio, Jo Ed, Rio Largo I and II, Las Villas Del Rio, Valle Alto 1-7, Old Town Site, and Sanchez Ranch). The connections reduced NPS loadings of BOD5 by 165 lbs/day, NH3-N by 33 lbs/day, TP by 7 lbs/day, and TN by 82 lbs/day. To accommodate the increase flows of wastewater from the connections, the City of Hidalgo built a new wastewater treatment facility in 2003. The new facility replaced an aging facultative lagoon system that produced wastewater BOD5 and TSS effluent concentrations in excess of the 30 mg/l and 90mg/l permit limits, respectively. The new mechanical treatment facility produces BOD5, TSS and NH3-N effluent concentrations of less than 10 mg/l 15 mg/l and 3mg/l, respectively.

McAllen Public Utility Board (McAllen PUB)

In 2002 and 2003, the McAllen PUB connected 2386 colonia residents to the city's wastewater collection system (including residences in Amigo Park 1-3, Adobe Wells Mobil, Gray, Requenez, Valley Memorial Gardens, Union Christiana, Vicente, Duarte, Hidden Meadows, and Mumford Trail Estates). The connections reduced NPS loadings of BOD5 by 249 lbs/day, NH3-N by 50 lbs/day, TP by 10 lbs/day, and TN by 124 lbs/day.

City of San Juan

In 2003, the City of San Juan connected 4939 colonia residents to the city's wastewater collection system, including 35 separate colonias located within the city's CCN area. The connections reduced NPS loadings of BOD5 by 515 lbs/day, NH3-N by 103 lbs/day, TP

by 22 lbs/day, and TN by 257 lbs/day. To accommodate the increase in flows of wastewater from the connections, the City of San Juan upgraded and expanded their wastewater treatment facility in 2003. The TCEQ reduced previous wastewater BOD5, TSS and NH3-N effluent concentrations of 20/20/4 to 10/15/3, respectively.

City of Pharr

In 2003 and 2004, the City of Pharr connected 8206 colonia residents to the city's wastewater collection system. All colonia residents connected to the city's wastewater collection system live in the Las Milpas colonia. The connections reduced NPS loadings of BOD5 by 855 lbs/day, NH3-N by 171 lbs/day, TP by 36 lbs/day, and TN by 428 lbs/day.

City of Mercedes

In 2004, the City of Mercedes connected 213 colonia residents to the city's wastewater collection system (including the DeAnda and Saenz colonias). The connections reduced NPS loadings of BOD5 by 22 lbs/day, NH3-N by 4 lbs/day, TP by 1 lb/day, and TN by 11 lbs/day.

Near-Term Infrastructure Improvements (2006-2010)

In the period of 2006 through 2010, wastewater treatment service providers in the Arroyo Colorado watershed plan to connect 58,610 additional colonia residents to centralized wastewater treatment services. These and other changes in infrastructure improvements will result in the mitigation of an additional 191,625 lbs/year of BOD, 153,300 lbs of TSS, 38,325 lbs/year of Ammonia Nitrogen, 95,630 lbs/year of Total Nitrogen, and 8,030 lbs/year of Total Phosphorus from rural and suburban domestic sources of wastewater. All changes in wastewater infrastructure in the watershed are summarized in the following paragraphs for the period of 2006-2010.

ERHWSC

Between the years 2001 and 2005, the ERHWSC completed the installation of a wastewater collection system designed to service 525 colonia residents living in the Las Yescas and Lozano subdivisions. Between 2006 and 2009, the ERHWSC will expand the collection system to service an additional 1,050 colonia residents living in the Lantana, San Vicente, La Tina Ranch, Floresville, and Arroyo Gardens subdivisions. The connections will reduce NPS loadings of BOD5 by 164 lbs/day, NH3-N by 33 lbs/day, TP by 7 lbs/day, and TN by 82 lbs/day. As described previously, in 2006, the ERHWSC will provide wastewater services to the residents of these colonias by completing construction of a new wastewater treatment facility with an effluent flow capacity of 0.16 MGD and maximum effluent concentrations of BOD5, TSS and NH3-N of 10/15/3, respectively. The outfall for this new treatment facility will flow into the Arroyo Colorado below the zone of impairment.

City of San Benito

In 2002, the City of San Benito connected 636 colonia residents to the city's wastewater collection system (including residences on Rice Tracts, Marydale Rd., Gamble Rd, East Stenger, Yost Rd., Camino Angosto, Leal Subdivision, Pennsylvania Rd. South

McCulloch St.). The connections will be activated in 2006 and are expected to reduced NPS loadings of BOD5 by 66 lbs/day, NH3-N by 13 lbs/day, TP by 3 lbs/day, and TN by 33 lbs/day. As described previously in this document, in 2006, the City of San Benito will complete construction of a new wastewater treatment facility that will increase the city's allowable wastewater discharge from 2.16 MGD to 2.5 MGD. Construction of the new facility will decrease the city's permitted point source load of BOD5, TSS, and NH3-N by 61%, 42% and 23% respectively from 2005 levels. In 2007, the City of San Benito will expand the flow capacity of the new wastewater treatment facility from 2.5 MGD to 3.75 MGD, increasing the loading of BOD5, TSS, and NH3-N by 50% from 2006 levels. The cumulative effects of these permit actions is an overall decrease in the loading of BOD5 from this facility of 42% (from 540 lbs/day to 313 lbs/day), a decrease in the loading of TSS of 13% (from 540 lbs/day to 469 lbs/day) and an increase in the loading of NH3-N of 16 % (from 81 lbs/day to 94 lbs/day). The TCEQ estimates the increase in the permitted point source loading of NH3-N is offset by the mitigation in NPS loading from colonias.

City of Rio Hondo

In 2006, the City of Rio Hondo will begin expanding the city's wastewater collection system to service the western and northern portions of the city's CCN. The City will begin providing centralized wastewater services to the estimated 328 residents located in these areas by 2007. The connections are expected to reduce NPS loadings of BOD5 by 34 lbs/day, NH3-N by 7 lbs/day, TP by 1.4 lbs/day, and TN by 17 lbs/day. As mentioned previously, to accommodate the increase in flows from the collection system expansion, the City of Rio Hondo will expand its current wastewater treatment facility to increase effluent flow from 0.4 MGD to 0.65 MGD. The City will also upgrade the treatment facility to decrease maximum effluent concentrations of BOD5 and TSS from 20/20 to 10/15/3 by 2010.

Near-Term Infrastructure Improvements (2006-2010)

HWWS

As mentioned previously in this document, in 2007 the TCEQ plans to issue a permit action designed to improve wastewater treatment at Harlingen Waterworks System's (HWWS') Wastewater Facility No. 1. The permit action will reduce the allowable wastewater effluent concentrations of BOD5 and TSS from the current 20/20 to 10/15 and will place a limit of 3 mg/l on the concentration of NH3-N allowed in the city's wastewater effluent (10/15/3). Additional improvements in infrastructure within the HWWS' Certificate of Convenience and Necessity (CCN) during the planning interval of 2006-2010 will be made available to the public following completion HWWS' Comprehensive Wastewater Master Plan in 2007.

City of La Feria

In 2003 and 2004, the City of La Feria connected 865 colonia residents to the city's wastewater collection system (including Barrington Heights, Alto Real and Bixby Subdivisions). In 2006, the City of La Feria will complete the connection of an additional 1,320 colonia residents to the city's wastewater collection system (including residents in the

Nancy, Soliceno, N. La Feria Village, Sierra Alto, Palmera Heights, Valverde, Windsong Village, and B.R. Subdivision)., The City is expected to begin treatment of wastewater collected from these colonias in 2007. The connections will reduce NPS loadings of BOD5 by 228 lbs/day, NH3-N by 46 lbs/day, TP by 10 lbs/day, and TN by 114 lbs/day. Also, as described previously in this document, the City of La Feria will begin construction of a new wastewater treatment facility that will reduce the city's point source loading of BOD5 and TSS to the Arroyo Colorado by 17%, 59%, respectively.

City of Mercedes

In 2006, the City of Mercedes will complete the connection of 5816 colonia residents to the city's wastewater collection system. The connections will reduce NPS loadings of BOD5 by 606 lbs/day, NH3-N by 121 lbs/day, TP by 26 lbs/day, and TN by 303 lbs/day.

MHWSC - Progreso

In 2006, the MHWSC will complete the connection of 84 colonia residents to the corporation's wastewater collection system (including residents in the Relampago colonia community and additional colonia residents near the City of Progreso). The connections will reduce NPS loadings of BOD5 by 9 lbs/day, NH3-N by 2 lbs/day, TP by 0.4 lbs/day, and TN by 4 lbs/day. As described previously in this document, the MHWSC will build a new wastewater treatment facility in 2007 to upgrade the existing wastewater treatment facility located in Progreso. The facility will be designed to produce 0.75 MGD of effluent treated to BOD5, TSS, and NH3-N concentrations of 10/15/3, respectively. As a result of construction of the new facility, permitted loadings of BOD5, TSS, and NH3-N from this facility to the Arroyo Colorado will be reduced by 38%, 69%, and 10% respectively.

City of Weslaco

In 2006, the City of Weslaco will complete the connection of 150 colonia residents to the city's wastewater collection system (i.e., Las Palmas subdivision). The city also has plans to provide wastewater service to an additional 5000 residents living in various colonias located in the western portion of the city's CCN in 2007 and 2008. Also in 2007, the City of Weslaco is partnering with the Renselaerville Institute to provide wastewater treatment for approximately 7000 colonia residents living outside of the City's CCN (e.g., Six-Pack Colonia STEP Project) including 1080 residents in Barbosa Lopez. The treatment of wastewater generated from the Six-pack connections will not be conducted by the City of Weslaco's Public Facilities Department, but rather wastewater treatment for the Six-Pack project will take place at a specially constructed evaporation basin located outside of the City of Weslaco's CCN. The extension of wastewater services to the colonia residents described above will reduce NPS loadings of BOD5 by 1266 lbs/day, NH3-N by 253 lbs/day, TP by 53 lbs/day, and TN by 633 lbs/day. As mentioned previously, the increase in wastewater expected from the connection of colonia residents to the city's collection system prior to 2010 will be partially accommodated by a planned expansion to the south wastewater treatment facility. The planned expansion will increase the permitted point source load of BOD5, TSS, and NH3-N from the City of Weslaco to the Arroyo Colorado by approximately 20%, 20%, and 21% respectively. However, The TCEQ estimates this increase in permitted loading is offset by the mitigation of loadings from untreated or

poorly treated wastewater from the colonias residents connected to the city's collection system and from wastewater services provided under the Six-pack project.

City of Donna

In 2006, the City of Donna will complete the connection of 5652 colonia residents to the city's wastewater collection system. The connections will reduce NPS loadings of BOD5 by 589 lbs/day, NH3-N by 118 lbs/day, TP by 25 lbs/day, and TN by 295 lbs/day. As mentioned previously, in order to accommodate the increase in wastewater generated by the new wastewater connections, the City of Donna will expand and upgrade its existing wastewater treatment facility from the current 2.5 MGD at 20/20 (2 DO) to 3.0 MGD at 10/15/3 (4.0 DO.) thereby reducing the current permitted loading of BOD5 from the City of Donna by 44% and TSS by 17%. The TCEQ expects the wastewater treatment facility expansion to be completed by 2008.

City of Hidalgo

In 2006, the City of Hidalgo will complete wastewater connections for an estimated 600 colonia residents. The connections will reduce NPS loadings of BOD5 by 63 lbs/day, NH3-N by 13 lbs/day, TP by 3 lbs/day, and TN by 31 lbs/day. In order to accommodate the increase in wastewater flowing into the existing wastewater treatment facility from these connections, the City of Hidalgo will expand the capacity of the city's existing wastewater treatment facility from the current 1.2 MGD to 1.4 MGD. The expansion will increase the permitted loading of BOD5, TSS and NH3-N from the City of Hidalgo by approximately 15%. However, the expanded wastewater treatment facility will include nutrient removal as part of the treatment system (tertiary treatment with denitrification and phosphorus removal or post treatment wetland cells/polishing ponds.)

City of Mission

In 2006, the City of Mission will complete wastewater connections for an estimated 7300 colonia residents located in the Northern portion of the city's CCN. In 2008, the city plans to provide wastewater services to an estimated 18,000 colonia residents living in 45 colonias also located in the northern portion of the city's CCN. The connections will reduce NPS loadings of BOD5 by 2636 lbs/day, NH3-N by 527 lbs/day, TP by 111 lbs/day, and TN by 1318 lbs/day. As mentioned previously, in order to accommodate the increase in wastewater flowing to the existing wastewater treatment facility from these connections, the City of Mission expanded and upgraded the current wastewater treatment facility to increase effluent flow from 4.6 MGD to 9.0 MGD. However, the city plans to begin expanding the treatment facility again in 2013 to increase effluent flow in 2015-2016 from 9.0 MGD to 13.5 MGD at the reduced wastewater effluent concentrations of BOD5, TSS and NH3-N of 7/12/1, respectively. The expansion in 2015 will include tertiary treatment with denitrification and phosphorus removal or post treatment wetland cells/polishing ponds. The planned 2015 expansion will increase the permitted load of BOD5 from the City of Mission to the Arroyo Colorado by 5%, and TSS by 20 %. However, the expansion will decrease the permitted load of NH3-N from the City of Mission to the Arroyo Colorado by approximately 25%. The TCEQ estimates the increase in point source loading of BOD5 and TSS is offset by the mitigation of colonia NPS loading as a result of the wastewater connections described above.

City of Pharr

In 2007, the City of Pharr plans to complete the connection of 2271 colonia residents living in the Las Milpas colonia (Las Milpas II) to the city's wastewater collection system. The connections will reduce NPS loadings of BOD5 by 237 lbs/day, NH3-N by 47 lbs/day, TP by 10 lbs/day, and TN by 118 lbs/day. As mentioned previously, the City of Pharr will upgrade and expand its current wastewater treatment facility to increase effluent flow from 5 MGD at 10/15/3 to 8 MGD at 7/12/2 by 2009. This expansion and upgrade will double the permitted effluent flow to the Arroyo Colorado while holding the permitted point source load of BOD5, TSS, and NH3-N at levels slightly higher than current discharge.

City of Alamo

Between 2006 and 2009, the City of Alamo plans to complete the connection of 1167 colonia residents to the city's wastewater collection system. The connections will reduce NPS loadings of BOD5 by 122 lbs/day, NH3-N by 24 lbs/day, TP by 5 lbs/day, and TN by 61 lbs/day. Also, as mentioned previously, in 2008, the City of Alamo will build a new wastewater treatment facility to upgrade the city's existing facility from the current 2.0 MGD at 30/90 to a 2.5 MGD at 10/15/3. The new facility will reduce the city's permitted point source loading of BOD5, TSS, and NH3-N to the Arroyo Colorado by 59%, 79% and 38% respectively.

City of San Juan

In 2009, the City of San Juan plans to complete the connection of 1810 colonia residents to the city's wastewater collection system. The connections will reduce NPS loadings of BOD5 by 189 lbs/day, NH3-N by 38 lbs/day, TP by 8 lbs/day, and TN by 94 lbs/day.

Long-Term Infrastructure Improvements (2011-2015)

In the period of 2011 through 2010, wastewater treatment service providers in the Arroyo Colorado watershed plan to connect 7,910 additional colonia residents to centralized wastewater treatment services. These and other changes in infrastructure improvements will result in the mitigation of an additional 30,660 lbs/year of BOD, 24,820 lbs of TSS, 6,205 lbs/year of Ammonia Nitrogen, 15,330 lbs/year of Total Nitrogen, and 1,095 lbs/year of Total Phosphorus from rural and suburban domestic sources of wastewater. All changes in wastewater infrastructure in the watershed are summarized in the following paragraphs for the period of 2011-2015.

ERHWSC – Arroyo City

The East Rio Hondo Water Supply Corporation plans to provide centralized wastewater services to an additional 175 colonia residents located in the eastern portion of Arroyo City by 2015. The connections will reduced NPS loadings of BOD5 by 18 lbs/day, NH3-N by 4 lbs/day, TP by 1 lbs/day, and TN by 9 lbs/day. As mentioned previously, treatment of wastewater will be accomplished through the construction of a new lagoon and constructed wetland wastewater treatment facility targeted for construction near Arroyo City in 2013.

City of Mercedes

As mentioned previously, in 2010, the City of Mercedes plans to begin expanding and upgrading the city's existing wastewater treatment facility from 2.3 MGD to 3.2 MGD at the current wastewater effluent concentrations of BOD5, TSS and NH3-N of 10/15/3, respectively. The City planned this expansion to accommodate the anticipated increase in wastewater flow to the current treatment facility from the connection of 446 households (approximately 1561 residents) located in the La Meza Subdivision and 10 additional unnamed colonias scheduled to be connected to the city's wastewater collection system between 2007 and 2010. The connections will reduce NPS loadings of BOD5 by 163 lbs/day, NH3-N by 33 lbs/day, TP by 7 lbs/day, and TN by 81 lbs/day. The city plans to include nutrient removal as part of the upgraded treatment system (tertiary treatment with denitrification and phosphorus removal or post treatment wetland cells/polishing ponds.) The expansion and upgrade will increase the city's BOD5, TSS, and NH3-N loadings to the Arroyo Colorado by approximately 39%. The TCEQ estimates the increase in permitted loading is offset by the mitigation of loadings from untreated or poorly treated wastewater from the colonias as a result of the wastewater connections.

The City of Donna

In 2010, the City of Donna plans to complete the connection of 3185 colonia residents to the city's wastewater collection system. The residents live in five colonias located in the north and west of the city. The connections will reduce NPS loadings of BOD5 by 332 lbs/day, NH3-N by 66 lbs/day, TP by 14 lbs/day, and TN by 166 lbs/day.

City of San Juan

Between 2010 and 2015, the City of San Juan plans to connect 4500 additional colonia residents to the city's wastewater collection system. The connections will reduce NPS loadings of BOD5 by 469 lbs/day, NH3-N by 94 lbs/day, TP by 20 lbs/day, and TN by 234 lbs/day.

City of Mission

In order to accommodate the increase in wastewater entering the collection system, the City of Mission plans to expand and upgrade the city's wastewater facility between 2015 and 2017, increasing the effluent flow capacity from 9.0 MGD to 13.5 MGD. As part of the permit amendment associated with the expansion of the wastewater treatment facility, the TCEQ will lower the allowable wastewater effluent concentrations of BOD5, TSS, and NH3-N from the current 10/15/2 to 7/12/1 respectively. The expansion and upgrade action will increase loading of BOD5 by 5% and decrease loading of NH3-N to the Arroyo Colorado by 25%.

City of Rio Hondo

By 2015, the City of Rio Hondo plans to connect 50 additional colonia residents to the city's wastewater collection system, reducing NPS loadings of BOD5 by 5 lbs/day, NH3-N by 1 lbs/day, TP by 0.22 lbs/day, and TN by 3 lbs/day. The 50 colonia residents are located in the Sam Houston area of the city's CCN.

Enhanced Treatment Projects

Enhanced treatment projects are voluntary measures undertaken by wastewater operators in the Rio Grande Valley to reduce the loading of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado using tertiary treatment mechanisms or post-treatment biological systems to polish treated effluent produced through conventional wastewater treatment. The projects described in the following sections can be placed into four main categories: 1) Reuse of treated wastewater effluent through landscape irrigation 2) effluent polishing pond systems 3) small-scale, constructed, free water, wetland systems and 4) tertiary wastewater treatment using denitrification. The wetland and polishing pond treatment systems proposed in this plan include structures that facilitate collection of water quality samples and measurement of flow downstream of the treatment system. Table 5 briefly describes the enhanced treatment projects completed to date and those proposed for implementation by 2015.

Table 5. Summary of historical and projected enhanced wastewater treatment projects for the period of 2000 through 2015

Wastewater Operator	Historical 2000-2005	Near-Term 2006-2010	Long-Term 2011-2015
Harlingen Water Works Wastewater Facility No.2	Reuse 0.5 MGD	NA	Reuse (unknown quantity)
City of Alamo	NA	NA	10-acre wetland
City of San Juan	NA	5-acre wetland	NA
City of Pharr	Reuse 0.6 MGD	NA	Reuse 0.4 MGD 20-acre pond
McAllen PUB	Reuse 0.4 MGD	NA	Reuse 1.0 MGD
City of Mission	Reuse 0.005 MGD	NA	Denitrification
City of La Feria	NA	4-acre wetland 6.75-acre Lagoon conversion to wetland	Reuse 0.33 MGD 2-acre wet pond 6-acre wetland
City of San Benito	NA	20-acre wetland	NA
City of Mercedes	NA	10-acre wetland	1 MGD to Regional Wetland
Military Highway WSC (Progreso)	NA	14-acre wetland	0.3 MGD to Regional Wetland
City of Weslaco	Reuse 1.0 MGD	25-acre wetland on TPWD land	1 MGD to Regional Wetland
City of Donna	NA	NA	2 MGD to Regional Wetland
City of Hidalgo	NA	1-acre pond	NA
City of Rio Hondo	NA	NA	0.5 MGD to Regional Wetland

NA signifies the measure is not applicable

History of Enhanced Treatment (2000-2005)

Enhanced treatment projects implemented in the watershed in the period of 2000 through 2005 consisted of five treated effluent reuse projects. Together, the reuse projects re-

sulted in the mitigation of 45,260 lbs/year of BOD, 10,950 lbs/year of Ammonia Nitrogen, 18,250 lbs/year of Total Nitrogen, and 1,825 lbs/year of Total Phosphorus from permitted effluent discharges. Descriptions of each enhanced treatment project implemented in the watershed in the period of 2000-2005 are presented below.

HHWS (Harlingen Water Works System)

In 2000, the HWWS began diverting 0.5 MGD of treated effluent from the Wastewater Facility No. 2 to Treasure Hills Country Club for irrigation. The diversion and reuse of treated effluent resulted in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 40 lbs/day, 56 lbs/day, 10 lbs/day, 2 lbs/day, and 17 lbs/day, respectively.

City of Pharr

In 2000, the City of Pharr began diverting 0.6 MGD of treated effluent from the city's wastewater treatment facility to the Tierra Del Sol Country Club golf course for irrigation. The diversion and reuse of treated effluent resulted in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to of 48 lbs/day, 68 lbs/day, 12 lbs/day, 2 lbs/day, and 20 lbs/day, respectively.

McAllen PUB

Prior to 2000, the McAllen PUB began diverting 0.25 MGD of treated effluent from the city's south wastewater treatment facility to the Palm View golf course for irrigation. The amount of effluent diverted to the Palm View Golf Course was increased to 0.4 MGD in 2004. The diversion and reuse of treated effluent resulted in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 32 lbs/day, 45 lbs/day, 8 lbs/day, 1 lbs/day, and 13 lbs/day, respectively.

City of Mission

In 2000, the City of Mission began diverting 0.005 MGD of treated effluent to the Cimarron golf course for irrigation. The diversion and reuse of treated effluent resulted in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 0.4 lbs/day, 0.6 lbs/day, 0.1 lbs/day, 0.02 lbs/day, and 0.2 lbs/day, respectively.

Near-Term Enhanced Treatment Projects (2006-2010)

Enhanced treatment projects planned in the watershed for the period of 2006 through 2010 consist of six wetland cell effluent polishing systems, one pond effluent polishing system, expansion of irrigation reuse, and construction of a regional wetland system. Implementation of these enhanced treatment projects will result in the mitigation of 90,155 lbs/year of BOD, 191,990 lbs of TSS, 33,945 lbs/year of Ammonia Nitrogen, 55,845 lbs/year of Total Nitrogen, and 4,380 lbs/year of Total Phosphorus primarily from permitted effluent discharges in the watershed. All Enhanced treatment projects in the watershed are summarized in the following paragraphs for the period of 2006-2010.

McAllen PUB

In 2006, McAllen PUB will increase the flow of treated effluent diverted from the south wastewater treatment facility to Palm View Golf Course to 0.5 MGD (an increase of 100,000 gal/day). The additional diversion of treated effluent will further reduce point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado by 8 lbs/day, 11 lbs/day, 2 lbs/day, 0.3 lbs/day, and 3 lbs/day, respectively.

City of La Feria

In 2005, TPWD awarded a grant to the City of La Feria to develop 25 acres of city-owned land into a wildlife and nature park in the southern portion of the city. The planned wildlife park includes a 4-acre wetland system and three pond gardens. The City plans to divert effluent from a planned new mechanical wastewater treatment facility to the nature park to provide water for the wetland and pond system and for landscape irrigation of the wildlife park (a total of 0.3 MGD for irrigation). The city will store the effluent planned for irrigation in a 2-acre holding pond prior to diverting it to the wildlife park. Construction of the Park began in 2005 and will be completed in 2006. In Addition to the wildlife park, the City of La Feria plans to convert the facultative lagoon system currently used to treat the city's wastewater into a shallow 6.75-acre wetland system capable of polishing 0.25 MGD of effluent produced by the new mechanical facility, which is scheduled for construction in 2006. Construction of the 4-acre wildlife park wetland and pond system, the 2-acre effluent holding pond and diversion of 0.33 MGD of effluent for irrigation of the wildlife park, and the conversion of the facultative lagoon system into a 6.7-acre wetland polishing system will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 43 lbs/day, 90 lbs/day, 16 lbs/day, 2 lbs/day, 25 lbs/day, respectively

City of Mercedes

In December 2005, the City of Mercedes began a feasibility study that will include investigation of options for tertiary treatment of wastewater, including biological nutrient removal and/or constructed wetland cells for post-treatment polishing of effluent (10 acres.) The City will begin implementation of feasible projects in 2007. Construction of the 10-acre wetland cell system, a top candidate for implementation, will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN of 15 lbs/day, 42 lbs/day, 7 lbs/day, 0.8 lbs/day, and 12 lbs/day, respectively.

City of San Juan

The City of San Juan is committed to achieving enhanced treatment of municipal wastewater by the year 2008. Early in 2006, the city investigated the feasibility of constructing a 5-acre wetland cell in land adjacent to the current mechanical wastewater treatment facility. The small wetland cell system is being designed to polish effluent from city of San Juan's wastewater treatment facility and also to treat urban storm water runoff. Additionally, the city plans to use the wetland site for public education, recreation and as a nature preserve. Construction of the wetland cell system will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 8 lbs/day, 21 lbs/day, 4 lbs/day, 0.4 lbs/day, and 6 lbs/day, respectively. Construction of the 5-acre wetland cell in the city of San Juan is scheduled for 2008.

Pending availability of funding and further inter-city negotiation, the City of San Juan may also partner with the City of Pharr to expand the currently planned 5-acre wetland and allow polishing of additional effluent diverted from the city of Pharr's wastewater treatment facility. However, discussions on this proposal are still preliminary.

City of San Benito

The City of San Benito is committed to achieving enhanced treatment of municipal wastewater by the year 2010. In 2006, the city will fund a feasibility study to convert the city's current wastewater pond system (approximately 20 acres) into a wetland cell system that will polish effluent from a new mechanical wastewater treatment facility scheduled for completion in 2006. In addition to wastewater polishing, the city also plans to use the wetland site for public education and recreation and as a nature preserve. Construction of the wetland cell system will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 31 lbs/day, 83 lbs/day, 15 lbs/day, 2 lbs/day, and 25 lbs/day, respectively.

MHWSC - Progreso

The MHWSC is planning to convert the pond system (14 Acres) currently used to treat wastewater collected from the City of Progreso into a wetland cell system which will be used to polish effluent produced from a new mechanical wastewater treatment facility planned for completion in June 2008. Construction of the 14-acre wetland cell system will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 21 lbs/day, 58 lbs/day, 10 lbs/day, 2 lbs/day, and 17 lbs/day, respectively.

City of Weslaco

In 2006, the City of Weslaco will begin diverting 1.0 MGD of treated effluent from the city's south wastewater treatment facility to the Tierra Santa Country Club golf course for landscape irrigation. The diversion and reuse of treated effluent will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 80 lbs/day, 113 lbs/day, 20 lbs/day, 3 lbs/day, 33 lbs/day, respectively The City of Weslaco also plans to divert as much as 1.0 MGD of treated effluent from the south wastewater facility to provide water for a 25-acre wetland cell system. Possible locations for the wetland include La Paloma Wildlife Management Area owned by TPWD. Construction of the wetland system is planned for 2008 pending the availability of grant funding. The planned wetland cell system will reduce point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado by 39 lbs/day, 104 lbs/day, 19 lbs/day, 2.0 lbs/day, 31 lbs/day, respectively.

Pending availability of funding and further negotiation, the City of Weslaco may also partner with the City of Donna to expand the currently planned 25-acre wetland and allow polishing of additional effluent diverted from the City of Donna's wastewater treatment facility. However, discussions on this proposal are still preliminary.

City of Hidalgo

The City of Hidalgo is committed to achieving enhanced treatment of municipal wastewater by the year 2009. As part of a planned expansion and upgrade of the city's current wastewater treatment facility (discussed in previous sections), the City of Hidalgo will include nutrient removal as part of the upgraded treatment system (tertiary treatment with denitrification and P removal or post treatment wetland cells/polishing ponds.) The City's waterworks department is currently evaluating options to convert the 1-acre facultative lagoon system used in the previous wastewater treatment facility into a polishing pond that will receive treated effluent from the current mechanical wastewater facility. Conversion of the old facultative lagoon into a polishing pond will reduce point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado by 0.25 lbs/day, 4 lbs/day, 0.5 lbs/day, 0.04 lbs/day, and 0.3 lbs/day, respectively.

Enhanced Treatment Projects

Long-Term Enhanced Treatment Projects (2011-2015)

HWWS

As mentioned previously in this document, HWWS plans to complete a Comprehensive Wastewater Master Plan to improve wastewater collection and treatment in the entire area specified in the HWWS Certificate of Convenience and Necessity (CCN). HWWS suspects preliminary results of the plan may indicate a high feasibility and need for wastewater reuse within HWWS' service area. Because the Wastewater Master Plan will not be completed until 2007, the size and scope of the proposed effluent reuse project(s) will not be known until late in 2007. Consequently, load reductions resulting from any reuse projects that may be proposed in the Wastewater Master Plan cannot be accurately calculated and are not included in this document.

City of Rio Hondo

The City of Rio Hondo is committed to achieving enhanced treatment of municipal wastewater by the year 2015. The City has agreed to divert 0.5 MGD of treated effluent to a proposed 80-acre birding center targeted for construction on property owned by the Port of Harlingen Authority by 2015. The diversion of treated effluent to ponds and constructed wetlands (13.5 acres of wetlands) in the proposed birding center will reduce BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado by 21 lbs/day, 56 lbs/day, 10 lbs/day, 1 lbs/day, 17 lbs/day, respectively

HWWS

The HWWS plans to contribute 5 MGD of treated wastewater effluent to a regional wetland system planned for construction in the vicinity of the Port of Harlingen by 2015. The planned diversion of treated effluent to the regional wetland system will result in the reduction of BOD5, TSS, NH3-N, TP, and TN loading to the Arroyo Colorado of 208 lbs/day, 563 lbs/day, 100 lbs/day, 11 lbs/day, and 167 lbs/day, respectively.

City of La Feria

By 2011, the City of La Feria plans to expand the wetland and nature preserve the city initiated in 2006. The expansion will include an additional 6 acres of wetland cells which will be situated on land adjacent to the planned 25-acre nature preserve. Expansion of the wetland and pond system will result in the additional reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 9 lbs/day, 25 lbs/day, 4 lbs/day, 0.5 lbs/day, and 7 lbs/day, respectively.

City of Mercedes

The City of Mercedes plans to contribute 1 MGD of treated wastewater effluent to a regional wetland system planned for construction in the vicinity of the Llano Grande by the year 2015. The planned diversion of treated effluent to the regional wetland system will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN of 42 lbs/day, 113 lbs/day, 20 lbs/day, 2 lbs/day, and 33 lbs/day, respectively. The regional wetland system proposed for construction in the Llano Grande area may also be designed to treat nonpoint source runoff from neighboring colonias, further reducing NPS pollution.

City of Weslaco

The City of Weslaco plans to contribute 1 MGD of treated wastewater effluent to a regional wetland system planned for construction in the vicinity of the Llano Grande by the year 2015. The planned diversion of treated effluent to the regional wetland system will result in the reduction of point source loadings BOD5, TSS, NH3-N, TP, and TN to the Arroyo Colorado of 42 lbs/day, 113 lbs/day, 20 lbs/day, 2 lbs/day, and 33 lbs/day, respectively. A regional wetland system in the vicinity of the Llano Grande area may also be capable of treating pollution from NPS runoff from neighboring colonias, further reducing NPS pollution.

MHWSC - Progreso

The MHWSC (Progreso wastewater treatment facility) plans to contribute 0.3 MGD of treated wastewater effluent to a regional wetland system planned for construction in the vicinity of the Llano Grande by the year 2015. The planned diversion of treated effluent to the regional wetland system will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN loading to the Arroyo Colorado of 13 lbs/day, 34 lbs/day, 6 lbs/day, 1 lbs/day, and 10 lbs/day, respectively. A regional wetland system in the vicinity of the Llano Grande area may also be capable of treating pollution from NPS runoff from neighboring colonias.

City of Donna

The City of Donna plans to contribute 2 MGD of treated wastewater effluent to a regional wetland system planned for construction in the vicinity of the Llano Grande by the year 2015. The planned diversion of treated effluent to the regional wetland system will result in the reduction of point source loadings of BOD5, TSS, NH3-N, TP, and TN of 83 lbs/day, 225 lbs/day, 40 lbs/day, 5 lbs/day, and 67 lbs/day, respectively. A regional wetland system in the vicinity of the Llano Grande area may also be capable of treating

storm water runoff from neighboring colonias. Pending availability of funding and further negotiation, the City Donna may also partner with the City of Wesalco to expand the 25-acre wetland currently planned for construction at the La Paloma Wildlife Management Area owned by TPWD, allowing the polishing of additional effluent diverted from the City of Donna's wastewater treatment facility. However, discussions on this proposal are still preliminary.

City of Alamo

By 2015, the City of Alamo plans to convert the city's current lagoon-based wastewater treatment system to a wetland polishing system which will polish effluent from a new mechanical wastewater treatment facility planned for construction in 2007. The planned (10-acre) wetland polishing system will reduce point source loadings of BOD5, TSS, NH3-N, TP, and TN by 15 lbs/day, 42 lbs/day, 7 lbs/day, 1 lbs/day, and 12 lbs/day, respectively.

City of Pharr

By 2011, the City of Pharr will begin diverting 0.4 MGD of treated effluent from the city's wastewater treatment facility to various city parks for irrigation. The City of Pharr will also divert an additional 1 MGD of treated effluent to a 20-acre wet pond system planned as part of a 100-acre inter-city wildlife and nature park located inside the Pharr city limits. The land for the proposed nature park contains a natural oxbow lake and is currently owned by the City of McAllen, which is also a partner in the project. The project is expected to be completed in 2012. The planned diversions to the polishing pond system will reduce point source loadings of BOD5, TSS, NH3-N, TP, and TN by 7 lbs/day, 103 lbs/day, 14 lbs/day, 1 lbs/day, and 8 lbs/day, respectively.

McAllen PUB

The McAllen PUB is investigating the feasibility of diverting additional effluent from the south wastewater treatment facility to a private golf course (0.30 MGD), two municipal parks (0.4 MGD) and a commercial development project (0.3 MGD for landscaping surrounding a proposed convention center) planned for construction between 2010 and 2015. The planned diversions will reduce point source loadings of BOD5, TSS, NH3-N, TP, and TN by 42 lbs/day, 99 lbs/day, 17 lbs/day, 2 lbs/day, and 24 lbs/day, respectively.

City of Mission

The City of Mission is committed to achieving enhanced treatment of municipal wastewater by 2017. The City of Mission plans to add denitrification to the current wastewater treatment system. Construction and operation of the denitrification units at the current wastewater treatment facility will reduce point source loadings of NH3-N, TP, and TN to the Arroyo Colorado by 8 lbs/day, 21 lbs/day, 2 lbs/day, 0.4 lbs/day, and 6 lbs/day, respectively.

LOAD REDUCTIONS

The overall loading reductions associated with the Arroyo Colorado Pollutant Reduction Plan are presented in Table 6. The changes in loading resulting from the measures described in the previous sections of this document are summarized in Table 7. The methodology used to calculate the load reductions (or increases) associated with changes in permit effluent requirements are simple mass balance calculations involving differences in permitted mass flux (mass flux = flow * concentration). The values shown in Table 7 represent permitted loadings. It is important to note that permitted loading and actual loading often differ significantly. Properly operated wastewater treatment facilities generally discharge less loading than allowed by their permit limits and some reduction of discharged loading is realized through attenuation as effluent flows and mixes with water in ditches before reaching a receiving water body. Therefore, the values shown in Table 7 probably over-represent actual daily loading from permitted wastewater outfalls, particularly in periods immediately following new permits and permit amendments. The 5-year implementation intervals used to calculate the overall loadings serve to smooth the differences between permitted loading and actual loading over each implementation interval.

Where outfall-specific permit information was not available for a specific constituent, as is universally the case for TP and TN, the following stoichiometric ratios 1.0:0.042:0.5:0.2 relating BOD:TP:TN:NH3-N were used. These ratios were based on published values for organic waste loads found in treated effluent.[8]

Table 6. Changes in total loading expected from implementation of the Arroyo Colorado Pollutant Reduction Plan in tons

Year	Estimated load to the Arroyo Colorado from municipal and domestic wastewater (tons)				
	BOD5	TSS	NH3-N	TN	TP
2000	5636	3664	1127	2818	237
2005	5762	3987	1153	2892	242
2010	4221	1659	937	2095	175
2015	3806	787	707	1778	153

The loading calculations associated with mitigation of NPS waste loads resulting from the connection of colonia residents to centralized wastewater systems are based primarily on the total population connected. In instances where only the number of connections was known, an assumption of 3.5 residents per connection was used to calculate the population served. For the amount of wastewater generated per capita in colonias, the value of100 gals/day was used. This value is the amount typically used by the TWDB, local planning organizations, and municipalities to design wastewater treatment systems for residents of the area. Wastewater from colonias was assumed to have very low levels of treatment consistent with typical basic onsite treatment (e.g., cesspools, pit privies, failing septic systems, etc.). To generate loading values with units of lbs/day, concentrations of

BOD5, TSS, NH3-N, TP, and TN of 125 mg/l, 100 mg/l, 25 mg/l, 5.25 mg/l, and 62.5 mg/l were applied, respectively, to the assumed 100 gal/day per capita wastewater volume. The constituent concentrations used in the calculations were derived using the medians of values obtained from published studies and modified using best professional judgment.[9] It should be noted that the timing, volume, dynamics and overall nature of steady-state vs. dynamic pollutant loading makes direct comparison of point and nonpoint source loads difficult even with the use of attenuation factors and averaging periods (≥5years).

The loading calculations associated with mitigation of NPS waste loads resulting from the connection of colonia residents to centralized wastewater systems are based primarily on the total population connected. In instances where only the number of connections was known, an assumption of 3.5 residents per connection was used to calculate the population served. For the amount of wastewater generated per capita in colonias, the value of 100 gals/day was used. This value is the amount typically used by the TWDB, local planning organizations, and municipalities to design wastewater treatment systems for residents of the area. Wastewater from colonias was assumed to have very low levels of treatment consistent with typical basic onsite treatment (e.g., cesspools, pit privies, failing septic systems, etc.). To generate loading values with units of lbs/day, concentrations of BOD5, TSS, NH3-N, TP, and TN of 125 mg/l, 100 mg/l, 25 mg/l, 5.25 mg/l, and 62.5 mg/l were applied, respectively, to the assumed 100 gal/day per capita wastewater volume. The constituent concentrations used in the calculations were derived using the medians of values obtained from published studies and modified using best professional judgment.[9]

The timing, volume, dynamics and overall nature of steady-state vs. dynamic pollutant loading makes direct comparison of point and nonpoint source loads difficult even with the use of attenuation factors and averaging periods (≥5years).

Table 7. Summary of load reductions expected from implementation of the Arroyo Colorado Pollutant Reduction Plan in tons for each load reduction measure category

Load Reduction Measure	Historical 2000-2005					Near-Term 2006-2010					Long-Term 2011-2015				
	BOD 5	TSS	NH3 -N	TN	TP	BOD 5	TSS	NH3 -N	TN	TP	BOD 5	TSS	NH3 -N	TN	TP
Institutional Controls	-540	-718	-113	-270	-23	837	1465	36	418	36	-101	-339	15	-36	-4
Infrastructure Improvements*	301	241	60	151	13	479	383	96	239	20	77	62	16	38	3
Enhanced Treatment	113	154	27	46	5	225	480	85	140	11	250	737	127	193	15
Total	**-126**	**-323**	**-26**	**-74**	**-5**	**1541**	**2328**	**216**	**797**	**67**	**226**	**460**	**128**	**195**	**14**

*Net NPS loading reductions from colonia wastewater connections (*e.g.*, gross loadings x 0.085).
Negative numbers signify increases in loading

The estimated NPS loadings presented previously in the Infrastructure Improvement section of this document were calculated to represent loading at the point of origin and do not represent what would be expected to enter the Arroyo Colorado after transport over land, in subsurface interflow, and in tributary ditches. In order to compare and sum loading reductions from the various measures described in this plan, a factor of 0.085 was applied to the gross NPS loading reductions estimated for all infrastructure improvements associated with colonia connections. The factor was developed through a comparison of simulated gross vs. simulated net loading using the HSPF watershed model developed for the Arroyo Colorado TMDL.

The loading calculations associated with enhanced treatment projects are based on information gathered from published reports on the effectiveness of pollutant removal from reuse via irrigation and on different biological effluent polishing systems or systems that employ similar methods to remove BOD, TSS, and nutrients from wastewater or storm water.

The removal efficiencies used to calculate load reductions associated with enhanced treatment systems are shown in Table 8. For irrigation reuse, the calculations assume that a minimum of 50 acres of irrigated land are needed for every MGD of effluent treated to reach the effectiveness values shown in Table 8.[10] For wetland cells polishing systems, maximum treatment flow volumes were calculated using an assumption that 27 acres of wetland cells (with 12-18 inches of standing water) are needed to treat 1 MGD of effluent.[11-16] For effluent polishing ponds, an assumption of 20 acres of pond surface with an average depth of 6 ft per MGD of effluent was used to calculate maximum treatment flow volumes. [17,18]

Table 8. Pollutant removal efficiencies of enhanced treatment systems

Treatment System	Removal Efficiency (%)				
	BOD5	TSS	NH3-N	TN	TP
Irrigation Reuse Systems	96	90	80	80	87
Wetland Cell Systems	50	90	80	80	65
Polishing Pond Systems	15	80	40	33	51

RESOURCE NEEDS

An assessment of the technical and financial assistance needed to implement the Arroyo Colorado Pollutant Reduction Plan is presented in the following sections.

Technical assistance needs were estimated based on information obtained from discussions and deliberations of the Arroyo Colorado Wastewater Infrastructure Work Group during meetings held in 2005 and 2006.

Estimates of the cost of construction and maintenance of the enhanced treatment projects described in this document were based on information compiled by Alan Plummer and Associates for TPWD and were included in a feasibility study completed in January, 2006 as part of efforts to develop the habitat restoration component of the Arroyo Colorado WPP.[19] Estimates of construction costs for new wastewater treatment facilities, wastewater treatment facility expansions and upgrades, and wastewater infrastructure improvements associated with colonia wastewater connections were obtained from public information provided by the TWDB, US Department of Agriculture Rural Development Program (USDA-RD), the North American Development Bank (NADBANK), and Texas Office of Rural Community Affairs (ORCA) and from local municipalities. Estimates of construction and maintenance costs associated with reuse through irrigation were obtained from local municipalities.

Technical Assistance Needs

Many of the measures described in this plan require technical assistance beyond that which is available to the operators of the wastewater treatment facilities that represent the principal point source contributors of pollutants of concern to the Arroyo Colorado. Small municipalities and water supply corporations, in particular, lack the staffing needed to compile site-specific data and information to conduct initial scoping, cost, and feasibility analyses to develop preliminary designs of proposed biological treatment systems. Technical staff is also needed to apply for grants and/or low interest loans to fund the enhanced treatment measures which often require preliminary site-specific designs and information.

Near-Term Technical Assistance Needs (2006-2010)

For the period of 2006-2010, five enhanced treatment projects are planned that will require technical assistance to secure grant and/or loan funding. These projects include: 1) conversion of a 6.75-acre wastewater treatment lagoon into a wetland cell system for effluent polishing for the City of La Feria, 2) conversion of a 20-acre wastewater treatment lagoon system into a wetland cell system for effluent polishing for the City of San Benito, 3) a 10-acre wetland system for effluent polishing for the City of Mercedes, 4) conversion of a 14-acre wastewater treatment lagoon system into a wetland cell system for effluent polishing for the MHWSC in Progreso and 5) a 1-acre effluent polishing pond for the city of Hidalgo. The Arroyo Colorado Wastewater Infrastructure Work Group estimates a minimum of 80 work hours of technical assistance by qualified professional staff will be required for each of the projects described above for a total of 480 working hours for the planning interval of 2006 through 2010.

Long-Term Technical Assistance Needs (2011-2015)

For the planning interval of 2011-2015, three enhanced treatment projects are planned that will require technical assistance to secure grant and/or loan funding. These projects include: 1) a 10-acre wetland system for effluent polishing for the City of Alamo, 2) a 6-acre wetland system and 2-acre pond system as part of the expansion of the City of La Feria's nature park and 3) a 20-acre effluent polishing pond (e.g., oxbow lake) for the City of Pharr and the City of McAllen. The Arroyo Colorado Wastewater Infrastructure

Work Group estimates a total of 250 work hours of technical assistance by qualified professional staff will be required for all three projects over the planning interval of 2011 through 2015.

Available Resources

Several outreach programs are available to provide municipalities and small water supply corporations the technical assistance needed to apply for funding to implement the enhanced treatment projects described in this document. Texas Sea Grant College and Texas A&M Cooperative Extension offer consultative services for land management to private landowners and local governments. Resources and information on biological treatment systems are also available through Texas Parks and Wildlife and the US Fish and Wildlife Service and several non-governmental organizations (NGOs), such as the Audubon Society, the Sierra Club, Ducks Unlimited, and the Trust for Public Lands, often assist local governments with land acquisition, preliminary design, and even construction of biological treatment systems that also provide natural habitat for native species. However, specific individuals (i.e., individual staff members) have not been identified to compile site-specific data and information for scoping and feasibility analyses or to develop preliminary designs of proposed biological treatment systems for specific municipalities or water supply corporations included in this plan.

Financial Assistance Needs

The amount of financial assistance needed to implement the Arroyo Colorado Pollutant Reduction Plan is presented in Table 9. Due to the uncertainty and variability associated with maintenance costs, only costs of construction are presented in this report. However, a reasonable assumption for estimating maintenance costs is to use a value equivalent to 10% of project construction costs per year. Detailed descriptions of each of the measures included in the funding estimates in Table 9 are provided in the following sections.

Table 9. Summary of total financial assistance needed to implement the Arroyo Colorado Pollutant Reduction Plan in dollars

Load Reduction Measures	Near-Term 2006-2010	Long-Term 2011-2015
Institutional Controls	$10,600,000	$7,550,000
Infrastructure Improvements	$13,873,286	$75,000
Enhanced Treatment	$11,747,000	$12,269,800
Total	**$36,220,286**	**$19,894,800**

Near-Term Financial Assistance Needs (2006-2010)

Ten load reduction measures associated with institutional controls (i.e., new discharge permits or amendment of exiting permits) for the planning interval of 2006 through 2010 are described in previous sections of this plan. These measures include construction of

five new wastewater treatment facilities (ERHWSC south of Rio Hondo, the City of San Benito, the City of La Feria, the City of Alamo and MHWSC in Progreso) and six expansions and/or upgrades of existing treatment facilities (City of Rio Hondo, City of Hidalgo, City of Pharr, City of Donna, City of Weslaco, and HWWS's #1 facility). The total estimated cost of these load reduction measures is $18,177,700. However, $7,577,700 was subtracted from this estimate because financial resources have already been secured for the projects in San Benito, La Feria, Pharr, and ERHWSC. Funding has not yet been secured for the remaining projects (upgrade of HWWS#1 Facility, MHWSC's new facility in Progresso, expansion of the City of Weslaco's facility, expansion and upgrade of the City of Donna's facility, a new facility for the City of Alamo, and expansion of the city of Hidalgo's existing facility. The resulting total cost of load reduction measures associated with institutional controls for the planning period of 2006 through 2010 is $10,600,000.

Within the planning period of 2006 through 2010, 58,610 colonia residents living in the Arroyo Colorado Watershed will be connected to various municipal wastewater collection systems (approximately 16927 total connections). Using an average cost of $1500/connection, the total estimated cost of these connections is $25,391,143. However, $11,517,857 of this total has already been secured through grants and low interest loans from various colonia infrastructure-funding agencies (i.e., TWDB, ORCA, USDA-RD, NADBANK, etc.). The resulting total cost of non-funded load reduction measures associated with wastewater infrastructure improvements for the planning period of 2006 through 2010 is $13,873,286.

Eight enhanced wastewater treatment projects and a 500-acre regional wetland system are planned for construction in the period of 2006 through 2010. These projects include: 1) construction of a 4-acre wetland and pond system and conversion of a 6.75-acre wastewater treatment lagoon into a wetland cell system for effluent polishing for the City of La Feria, 2) construction of a 5-acre wetland cell system for effluent polishing for the City of San Juan 3) conversion of a 20-acre wastewater treatment lagoon system into a wetland cell system for effluent polishing for the City of San Benito, 4) a 10-acre wetland for effluent polishing for the City of Mercedes, 5) conversion of a 14-acre wastewater treatment lagoon system into a wetland cell system for effluent polishing for the MHWSC in Progreso 6) a 1-acre effluent polishing pond for the city of Hidalgo 7) expansion of irrigation reuse by the McAllen PUB and 8) construction of a 25-acre wetland cell system on TPWD property which will receive treated effluent from the City of Weslaco. In addition to these projects, a 500-acre regional wetland system is planned for construction on undeveloped land located southeast of the Port of Harlingen. If financial support is secured for this regional wetland project, wastewater treatment facilities operated by the cities of San Benito, Harlingen, Rio Hondo, and MHWSC-Lago will contribute effluent to the regional wetland providing further enhanced treatment of point source pollution.

Cost estimates for wetland construction are based on average per-acre values suggested in the report titled Feasibility Study for Habitat Restoration/Modification to Improve Water Quality in the Arroyo Colorado by Alan Plummer and Associates[19] with modifications based on best professional judgment. The cost estimates of effluent reuse through irrigation was based on the cost of setting pipe over the conveyance distance from the outfall to

the proposed irrigation application location plus $3,000 per pumping unit for instances in which the proposed irrigation application location was located at an elevation higher than the current wastewater outfall.

Based on construction costs of $20,000/acre for wetland cells, $13,000/acre for wet pond systems, $1/linear ft. of installed piping and 567 acres of wetland area, a 1-acre effluent polishing pond, 28,000 ft. of installed pipe and two effluent pumping systems, the estimated total cost of load reduction measures associated with enhanced treatment systems for the planning interval of 2006 through 2010 is $11,747,000.

Long-Term Financial Assistance Needs (2011-2015)

Four load reduction measures associated with institutional controls for the planning interval of 2011 through 2015 are described in previous sections of this plan. These measures include construction of one new wastewater treatment facility (ERHWSC near Arroyo City) and expansions and/or upgrades of 3 existing facilities (City of Mission, City of Mercedes, City of Rio Hondo). The total estimated cost of the load reduction measures associated with institutional controls is $7,550,000 for the planning interval of 2011 through 2015. Financial resources have not been secured for any of the institutional control projects described above.

Also within the planning interval of 2011 through 2015, 9471 colonia residents living in the Arroyo Colorado Watershed will be connected to various municipal wastewater collection systems (approximately 2,706 total connections). The total estimated cost of these connections is $4,051,000. However, $3,984,000 is either funded or earmarked for funding through grants and low interest loans from various colonia infrastructure-funding agencies (i.e., TWDB, ORCA, USDA-RD, NADBANK, etc.). The resulting total cost of non-funded load reduction measures associated with wastewater infrastructure improvements for the planning interval of 2011 through 2015 is $75,000.

Three enhanced wastewater treatment projects and a 300-acre regional wetland system are planned for construction in the planning interval of 2011 through 2015. These projects include: 1) a 10-acre wetland for effluent polishing for the City of Alamo, 2) a 6-acre wetland and 2-acre pond system as part of the expansion of the City of La Feria's nature park, 3) a 20-acre effluent polishing pond (e.g., oxbow lake) for the City of Pharr and the City of McAllen, and 4) a 300-acre regional wetland system in the Llano Grande area of the Arroyo Colorado. The estimated total cost of construction for the load reduction measures associated with enhanced treatment systems for the planning interval of 2011 through 2015 is $12,269,800. Financial resources have not been secured for any of the enhanced treatment projects described above.

Available Resources

Several federal and state grant and low interest loan programs are available to finance many of the load reduction measures described in the Arroyo Colorado Pollutant Reduction Plan. Additionally, several national and regional non-governmental organizations offer financial support to local governments to implement environmental projects.

Federal

The USEPA's CWA §319 Program offers grants for projects designed to mitigate urban and agricultural NPS pollution. The USEPA also provides funding to improve wastewater infrastructure of low-income communities through the Colonia Wastewater Treatment Assistance Program (CWTAP). The USEPA's Gulf of Mexico Program offers small grants for projects designed to restore or enhance the environment along the Gulf of Mexico. Other federal agencies such as the North American Development Bank (NADBANK) and the US Department of Agriculture (USDA-RD) also provide grant and low interest loan funding for wastewater infrastructure projects. The US Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Administration (NOAA) and the US Army Corps of Engineers (USACE) all administer grant programs for environmental restoration and protection projects.

State

The TWDB and ORCA offer grant and low interest loans to improve wastewater infrastructure in low-income communities under the Economically Distressed Area Program (EDAP). Low interest loans are also available under the TWDB's CWA State Revolving Fund program. The Texas General Land Office administers several grant programs that fund environmental protection and restoration projects located or associated with the Coastal Zone management Program. TPWD also offers grant funding for environmental restoration and protection projects throughout the state and the Texas Department of Transportation makes grants available for water quality improvement associated with transportation corridors.

Non-Governmental

Several non-governmental organizations such as the Audubon Society, the Sierra Club, Ducks Unlimited, and the Trust for Public Lands also offer grant funding for projects associated with environmental restoration and protection.

MONITORING AND REPORTING

Monitoring is an essential part of any watershed plan. Effective water quality monitoring is necessary to assess the overall health of the Arroyo Colorado and to determine trends over time. Monitoring also helps refine pollution load estimates, which are critical to the success of the watershed plan and are also a requisite to establishing a pollutant trading system. As part of the Arroyo Colorado Pollutant Reduction Plan, two different types of effluent quality monitoring will be implemented for the planning period of 2006-2015. Under the plan, the principal point source contributors of pollutants of concern to the Arroyo Colorado (Table 2) will monitor flow, BOD5, TSS, nutrients and bacteria at the each of the 18 permitted outfall locations. Additionally, wastewater treatment facility operators implementing enhanced treatment projects under this plan will also monitor flow, BOD5, TSS, and nutrients at the polished outfall locations downstream of the enhanced treatment areas.

Nutrient and Bacteria Sampling and Analysis

Most permitted dischargers in the Arroyo Colorado watershed, including the 18 principal point source contributors of pollutants of concern to the Arroyo Colorado, monitor and report effluent quality on a monthly basis as part of the requirements described in each of the individual TPDES permits. Each facility collects effluent samples over a 24 hr period, combines the samples into a single composite sample, and analyzes the sample or submits the sample for analysis by a certified laboratory. The samples are typically analyzed for BOD5, TSS, and chlorine residual. The analytical results of the effluent samples are reported to the TCEQ and the data is entered into a national database called the Permit Compliance System (PCS). In addition to BOD5, TSS, and chlorine residual, some TPDES discharge permits for facilities located in the Arroyo Colorado watershed also require monitoring of additional parameters such as NH3-N and bacteria (i.e., fecal coliform or E-coli). TPDES permits for facilities located in the Arroyo Colorado watershed do not currently require effluent sampling and analysis for nutrients.

In order to better characterize the loading of nutrients to the Arroyo Colorado from treated wastewater, additional monitoring requirements will be placed in the TPDES permits of the 18 principal point source contributors of pollutants of concern to the Arroyo Colorado (Table 2). Beginning in 2006, TPDES permits for the 18 facilities in Table 2 will require effluent monitoring for additional nutrient parameters and bacteria. Table 9 shows the additional nutrient and bacteria parameters which will be required under the plan.

The changes to the TPDES permits requiring nutrient monitoring will not constitute effluent limitations for these parameters. The permit changes will simply require only the monitoring and reporting of these parameters. Sampling, analysis, and reporting of these parameters will be conducted in the same fashion as the sampling analysis, and reporting of other parameters currently required under the individual TPDES permits for each of the 18 facilities shown in Table 2.

Effectiveness Monitoring

In addition to outfall monitoring, wastewater operators implementing enhanced treatment projects under the Arroyo Colorado Pollutant Reduction Plan will also provide a means to assess the pollutant removal effectiveness of the enhanced treatment projects by monitoring flow, BOD5, TSS and nutrients at outfall locations situated downstream of the enhanced treatment project areas.

Monitoring will be conducted monthly and as close as possible to the time of collection of the outfall nutrient sampling described in the previous section. The same sampling technique will be employed for both types of sampling (i.e. 24-hr composite sampling). In addition to measuring flow, effectiveness monitoring samples will be analyzed for the same five nutrient parameters shown in Table 10 as well as for BOD5 and TSS.

Wastewater operators implementing reuse through irrigation will be exempt from effectiveness monitoring under this plan.

IMPLEMENTATION SCHEDULE

Due to the uncertainty inherent in this, and most, planning efforts, the exact date of implementation for each individual load reduction measure described in this document cannot be estimated with any degree of certainty. However, estimates of implementation of individual measures are possible with anticipated error factors of approximately 1.5-2.0 years. The anticipated year of implementation of each of the load reduction measures contained in this plan has been described in previous sections. Figure 4 shows a timeline that summarizes the implementation schedules for all the measures described in previous sections of this document.

Table 10. List of nutrient and bacteria parameters monitored by principal point source contributors of pollutants to the Arroyo Colorado under the Arroyo Colorado Pollutant Reduction Plan.

Parameter	Parameter Code
Total Phosphorus as P (mg/l)	00665
Total Phosphate as $PO4^{-3}$ (mg/l)	00650
Total Ammonia Nitrogen as N (mg/l)*	00610
Total Kjeldahl Nitrogen as N (mg/l)	00625
Total Nitrite plus Nitrate Nitrogen as N (mg/l)	00630
E. coli (#/100ml)*	31648

* Monitoring is only required if this parameter is not already being monitored

It is evident from Figure 4 that the majority of load reduction efforts associated with institutional controls will occur in the first two years of the plan, whereas additional infrastructure improvements and most enhanced treatment projects are scheduled for implementation after 2007.

MILESTONES AND MEASURES OF SUCCESS

For the purpose of this document, milestones are defined as interim goals which mark progress towards an ultimate goal. Measures of success are defined as standards or metrics by which progress toward an ultimate goal is gauged. In order to be meaningful, both of these definitions require a detailed description of the interim and ultimate goals of this plan.

The ultimate goal of the Arroyo Colorado Pollution Reduction Plan is to reduce the loading of wastewater-related pollutants of concern to the Arroyo Colorado to the maximum extent practicable.

One of the stated priorities of the Arroyo Colorado Pollution Reduction Plan is the elimination of all 30/90 permits in the Arroyo Colorado watershed by 2010. Another stated priority of the Arroyo Colorado Pollution Reduction Plan is the lowering of all allowable

effluent discharge limits in the Arroyo Colorado watershed to 10/15/3 by 2015. Both of these priorities can be considered milestones towards the ultimate goal of reducing the loading of wastewater-related pollutants of concern to the Arroyo Colorado to the maximum extent practicable. Additional milestones of this plan include centralized wastewater treatment and/or adequate and sustainable onsite wastewater treatment for 95% of all colonia residents living in the Arroyo Colorado Watershed by 2010. Finally, the TCEQ estimates that the permitted point source loading of BOD, TSS, and nutrients to the Arroyo Colorado can be further reduced by 10-15% through enhanced biological treatment (i.e., polishing) of treated effluent produced by the principal point source contributors of pollutants of concern in Arroyo Colorado.

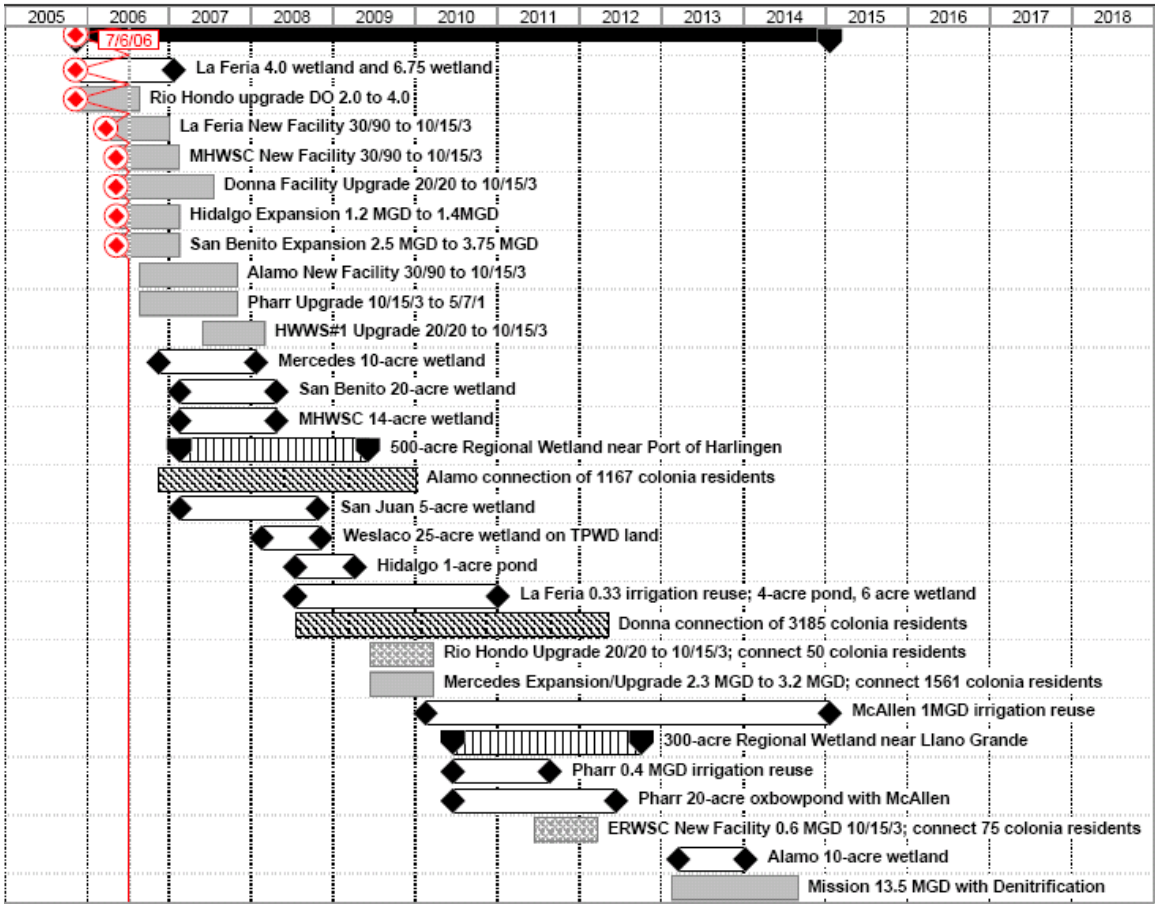

Figure 4. Timeline for implementation of the Arroyo Colorado Pollutant Reduction Plan

The measures of success used to gauge the progress made in achieving the goals and milestones described above are the following: 1) an accounting of permit actions resulting in treatment levels of 10/15/3 or lower and the time the permit actions occur 2) accurate measurement of the current loading of pollutants of concern emanating from the principal point source contributors to the Arroyo Colorado 3) measurement of the reduction in loading of pollutants of concern achieved from implementation of enhanced wastewater treatment projects in the Arroyo Colorado watershed and 4) an accounting of

the total number of colonia residents as well as the number of colonia residents with access to centralized wastewater treatment or with adequate and sustainable onsite wastewater treatment systems.

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